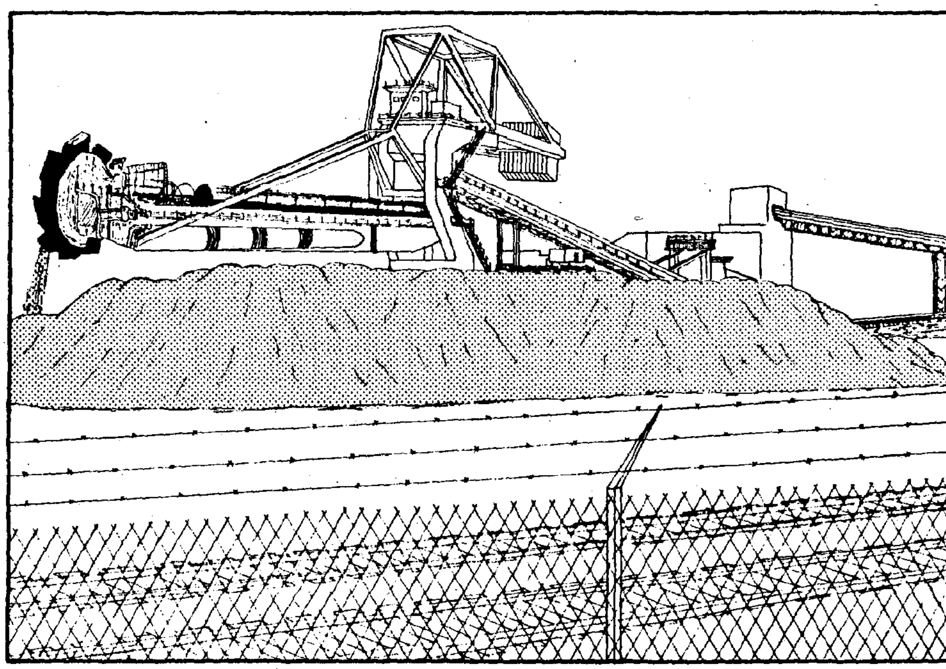
The Regional Impact of Coal Export

Baltimore Metropolitan Area



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THE REGIONAL IMPACTS OF COAL EXPORT IN THE BALTIMORE METROPOLITAN AREA

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EXECUTIVE SUMMARY

COAL PROJECTIONS

By the year 2000, coal exports through the Port of Baltimore are projected to be between 24 and 50 million tons, with a "most likely" scenario of 38 million tons. The most likely case is nearly three times the level of 1981's record high 13 million tons. These projections were based on national projected exports from a number of studies and on the Port of Baltimore's and other ports' coal facility expansion plans. Although worldwide demand for U.S. steam coal has slumped the last two years for a variety of reasons (the worldwide recession, an historic lowering of the price of oil, and the end to labor strife in Poland and Australia), the basic assumptions of worldwide energy demand and resource availability which formed the underpinnings of the national coal projections, we feel, remain valid.

EMPLOYMENT

Employment directly associated with coal exports in Baltimore amounted to between 1,400 and 1,500 workers in 1980. If the multiplier effects are accounted for, the total job impact is somewhere betweeen 2,800 and 3,000 jobs. By year 2000, under the "most likely" scenario, almost 3,000 jobs would be directly associated with the projected coal volumes. Taking into account multiplier effects, total employment directly and indirectly associated with the projected coal export tonnage would be approximately 6,200. Of these 6,200 jobs, over 2,700 would be associated with the railroad and the coal piers. Another 1,000 would be in "personal, business, and other services." The remainder would be retail and wholesale trade and other spinoffs. The employment projections for the year 2000 assume the operation of the three existing coal piers in the Port of Baltimore at or near their capacities.

FISCAL BENEFITS

Over the 1985-2004 time span, under the "most likely" scenario, the present value of the stream of benefits to the private sector (which includes all output and wages and salaries paid to workers) amounts to $1.8 billion. Of this total, the majority (nearly 48 percent) accrues to Baltimore City, while 14 percent goes to Anne Arundel County and 31 percent to Baltimore

County. Harford and Howard counties each accrue 3 percent, while Carroll County receives 2 percent of the total benefits.

The net present value of the stream of public benefits to the local jurisdictions between 1984 and 2004, consisting of local personal income taxes and local corporate personal and property taxes amounts to $19.0 million. Of this total, $11.9 million is allocated to Baltimore City, $1.8 million to Anne Arundel County, and $4.3 million to Baltimore County. Carroll County would receive $.2 million, while Howard and Harford Counties would each receive about $.4 million.

The net present value of the stream of benefits to the state (state personal income taxes, state corporate personal and property taxes and state corporate income taxes and state sales taxes) amounts to nearly $44.5 million.

ENVIRONMENTAL AND COMMUNITY IMPACTS

Unless dust suppression is employed on coal trains, the year 2000 "most likely" volumes will significantly increase the amount of particulates in the region, at least doubling the amount emitted by area sources (7,700 tons/year) in 1980. Area sources were approximately 9 percent of total particulates (87,000 tons) emitted in 1980.

Water quality impacts, including reduced pH (increasing acidity) and increased leaching of metals will result from dust emissions if they are not suppressed. Fisheries in the Patapsco are now recovering from other stresses. New stress resulting from coal dust would delay or prevent this recovery.

Noise impacts are the most pervasive and difficult to mitigate in the Patapsco River Valley. By the year 2000, noise levels will "greatly annoy" between 15 and 30 percent of the people living within 400 feet of the tracks (700 - 1,450 people). Noise levels would be high enough to mobilize these people to seek legal remedies.

Access will be limited by the increased rail traffic in a number of locations, especially in the more developed areas of the region. Increased rail traffic increases the chances of a train becoming disabled at any one of these locations, in some cases completely isolating residents and businesses from normal access as well as emergency services. The following locations are affected by the year 2000 "most likely" scenario: Hollins Ferry Road, Waterview Avenue, Boston Street, and Marriottsville Road. Development of the Marley Neck Terminal would also affect Pennington Avenue, Ordinance Road, and Kenbo Road (sole access to Kennecott Copper).

RECOMMENDATIONS FOR MITIGATION OF ADVERSE IMPACTS

In general, the economic benefits of increased coal export allow sufficient funds in both public and private sectors to pay for the mitigation of most adverse impacts. The timing of revenue increases and when certain improvements may be necessary has yet to be explored. Assuming these can be coordinated, the following recommendations are made.

Dust suppression should be required for all coal trains, even if it is necessary more than once between the mines and the Port of Baltimore. The economic value of the coal retained would likely pay for the installation of the simple devices needed to spray each car as it moves along the tracks. The public health, water quality, and property value impacts to be avoided would more than justify any private cost incurred over the value of the coal retained.

The report identifies schools, hospitals and residential areas where noise barriers and sound insulation may be necessary in the B & O Rail corridor. Each jurisdiction should study in detail those populations affected by noise and access impacts as noted in the report and explore specific solutions to these problems. The access and safety improvements listed in the report should be programmed so that they coincide with increases in rail traffic.

The costs given within the report are ballpark figures based on preliminary analyses. Individual jurisdictions must select appropriate solutions and develop detailed cost estimates.

FUNDING SOURCES FOR MITIGATION ACTIVITIES

Funds for access improvements, especially the suggested grade separations, would come from federal, state, and local transportation budgets. The Boston Street project would be funded 100 percent by Interstate

Transfer Funds. The Marriottsville Road project could be funded 80 percent by the Maryland Department of Transportation, and 10 percent each by Howard and Carroll counties.

Dust suppression should be funded by the coal companies as a means of reducing both weight and volume losses en route. The enonomic benefits accruing to the coal companies can cover most of these costs.

The costs of noise barriers, fencing, and safety improvements (speed sensitive signals, detours and emergency access) will probably have to be negotiated between public and private sectors according to existing laws and precedents.

CONCLUSIONS AND RECOMMENDATIONS

The year 2000 "most likley" projections for coal export will be accommodated by the existing (1983) coal terminals: Curtis Bay, Island Creek and Consolidation. Several actions will be necessary to mitigate the impacts of increased rail traffic. These include:

- Dust suppression for rail cars, especially in the B & O Corridor.
- Grade Separation at Boston Street.
- Safety and access improvements at grade crossings with low auto traffic in Baltimore City (see companion report, Baltimore City Planning Department).
- Playground relocations, protective fencing and noise or visual barriers in residential areas of Baltimore City.

In addition, the suburban jurisdictions should begin a detailed study of specific areas (noted in the report) where fencing and noise or visual barriers may be necessary to mitigate the environmental impacts of increased traffic. A task force of representatives from Howard, Baltimore and Carroll Counties and the RPC should meet as coal traffic increases to consider the needed improvements and traffic projections. The at-grade crossings on the borders between these jurisdictions are of particular concern. The Marriottsvile Road crossing is one that should be studied in connection with long-range land use and transportation plans. This task force could act as a watch dog on coal traffic in the B & O corridor, and work with Baltimore City and Harford County on a region-wide strategy when necessary.

Special studies will be needed if another coal terminal such as Marley Neck or Sparrows Point were scheduled for construction. A considerable number of troublesome at-grade crossings in Baltimore City, Baltimore County and Anne Arundel County would be affected.

Benefits outweigh costs for the "most likely" scenario for private and public interests, with the exception of Baltimore City. (This aspect is examined in more depth in their companion report.) The railroads benefit most, and the state will benefit more than the local jurisdictions in the region. The equity between public costs and private benefits must be considered, especially in Baltimore City. Appropriate, case-by-case enforcement of City regulations requiring the railroad to pay for grade separations and improvements of at-grade crossings should also be considered to balance the cost/benefit ratio.

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CHAPTER I
INTRODUCTION

BACKGROUND

The genesis of this report goes back to the tremendous increase in steam coal exports from the United States to Europe and the Far East in 1980. At that time, coal-exporting facilities in Baltimore and at other ports were being pushed to their limits, with delays of 30 to 40 days for ships to load their cargo not uncommon. Coinciding with this upsurge in steam coal exports, numerous studies were published detailing significant increases in coal export volumes from the United States in the next two decades. Against the background of these projected increases in nationwide coal exports, came proposals to build two and possibly up to four additional coal terminals in the Port of Baltimore.

Concern was expressed from many quarters at the height of the coal boom about the effects of increased rail and ship movements to and from the Port of Baltimore. How would these increases in jobs and income be distributed in the Baltimore Region (Baltimore City, and Anne Arundel, Baltimore, Carroll, Harford and Howard Counties)? What would be the magnitude of the associated adverse impacts such as increases in noise, pollution and traffic congestion in neighborhoods and near valuable port property? What would it cost to mitigate these adverse impacts?

This report will provide some answers to the above questions so that a more complete understanding of the impact to the Baltimore Region of increased coal traffic will be possible. With a fuller understanding of the total ramifications of increased coal exports through the Port of Baltimore, i.e., its benefits and costs, it is hoped that, where necessary, adjustments in policy as well as infrastructure could be made by state, local and port officials in an orderly and efficient manner.

At the time that this report is to go to press (December 1983), significant events have altered the characteristics of the world coal trade which were in evidence during the height of the coal boom in 1980-1981. Demand for U.S. steam coal has substantially subsided due to a number of factors, including: the end to labor strike by miners in Australia, increased production from Poland, an historical lowering of the price of oil by OPEC, and a world-wide recession. Locally, only two coal terminal projects have been built in the Port of Baltimore; the two others have been indefinitely postponed.

Nevertheless, given the political instability of the traditional suppliers of oil to a good portion of the world, the uncertainty attached to the growth of nuclear energy and the probable recovery of the industrial and developing nations' economies, we feel that the increases in coal usage projected earlier are still valid. It is probable, however, that the effects of the increased demand will be felt more gradually than originally predicted.

METHODOLOGY

Estimates of future coal exports through the Port of Baltimore were made by the Regional Planning Council for the years 1985 through 2000, at five year intervals, based on national projected exports from a number of studies, and on the Port of Baltimore's and other ports' coal facility expansion plans.

Economic impacts to the Baltimore Region from 1980 and future volumes of coal exports were estimated by use of the Baltimore Regional Input-Output Model (BRIO). Employment directly associated with coal exports in the Baltimore Region in 1980 was taken from a Booz, Allen & Hamilton, Inc. study completed for the Greater Baltimore Committee.[1] These direct employment numbers were translated into regional output and entered into the BRIO model to yield total output and employment impacts (including the multiplier effects).

Future direct employment impacts were calculated based on projected coal volumes, number of coal ships, and days in port per ship. The BRIO model was again used to yield total employment and output impacts.

Fiscal impacts were estimated from data supplied by the BRIO model and from public tax records.

Environmental and community impacts were estimated with a variety of simple models and qualitative observations. Funding limitations did not permit detailed site-specific analysis (except in cases where such work had

[1] The Economic Impacts of the Export of Coal Through the Port of Baltimore. Booz, Allen & Hamilton, Inc., December 1981.

already been completed by Baltimore City), so impacts are described for their general magnitude and locations are identified for further analysis by local jurisdictions.

CHAPTER II

COAL EXPORT PROJECTIONS FOR THE PORT OF BALTIMORE

HISTORICAL TRENDS

The United States export market for coal consists of both steam coal used in industrial and utility boilers and metallurgical (met) coal used in the making of steel. The export market has traditionally been divided into two segments--exports to Canada and overseas exports, which represent all other countries of destination. Until 1980, the coal sold to the overseas market was almost exclusively met coal, while exports to Canada were more balanced in terms of steam and met coal. Figure 2.1 illustrates major coal trade routes and the known reserves of coal in the major exporting countries.

In 1979, the United States began exporting a small amount of steam coal overseas, accounting for only 2.5 million tons out of a total market of 45.6 million tons. Beginning in 1980, overseas steam coal exports increased dramatically, (to 16 milliion tons) as countries throughout the world began substituting relatively low priced steam coal for higher priced oil to satisfy their energy needs. It is expected that the majority of growth in coal exports over the next 20 years will be steam coal shipped to overseas markets to be used as a replacement for oil in the world economy.

The dramatic increase in steam coal tonnage exported occurred in 1980 leading to a large overall increase in coal exports (see Table 2.1 and Figure 2.2). This increase continued through 1981 but declined somewhat in 1982. Baltimore's share of national overseas exports increased steadily, peaking in 1979, when it reached a 20 percent share. The percentage of national coal exports passing through Baltimore has decreased since then as export volumes reached the upper limits of the lone exporting pier in the port (Chessie's Curtis Bay Facility).

In addition to Baltimore, the ports making up Hampton Roads also lost a significant share of the export market since 1979. The loss here also stems from port congestion caused by the steam coal export boom, which led buyers to switch to alternate ports. The main benefactors of the east coast congestion were the Gulf ports of New Orleans and Mobile, and the West Coast ports of Los Angeles and Long Beach. (Table 2.2 lists the major ports of exit for overseas coal for the years 1979-1982.)

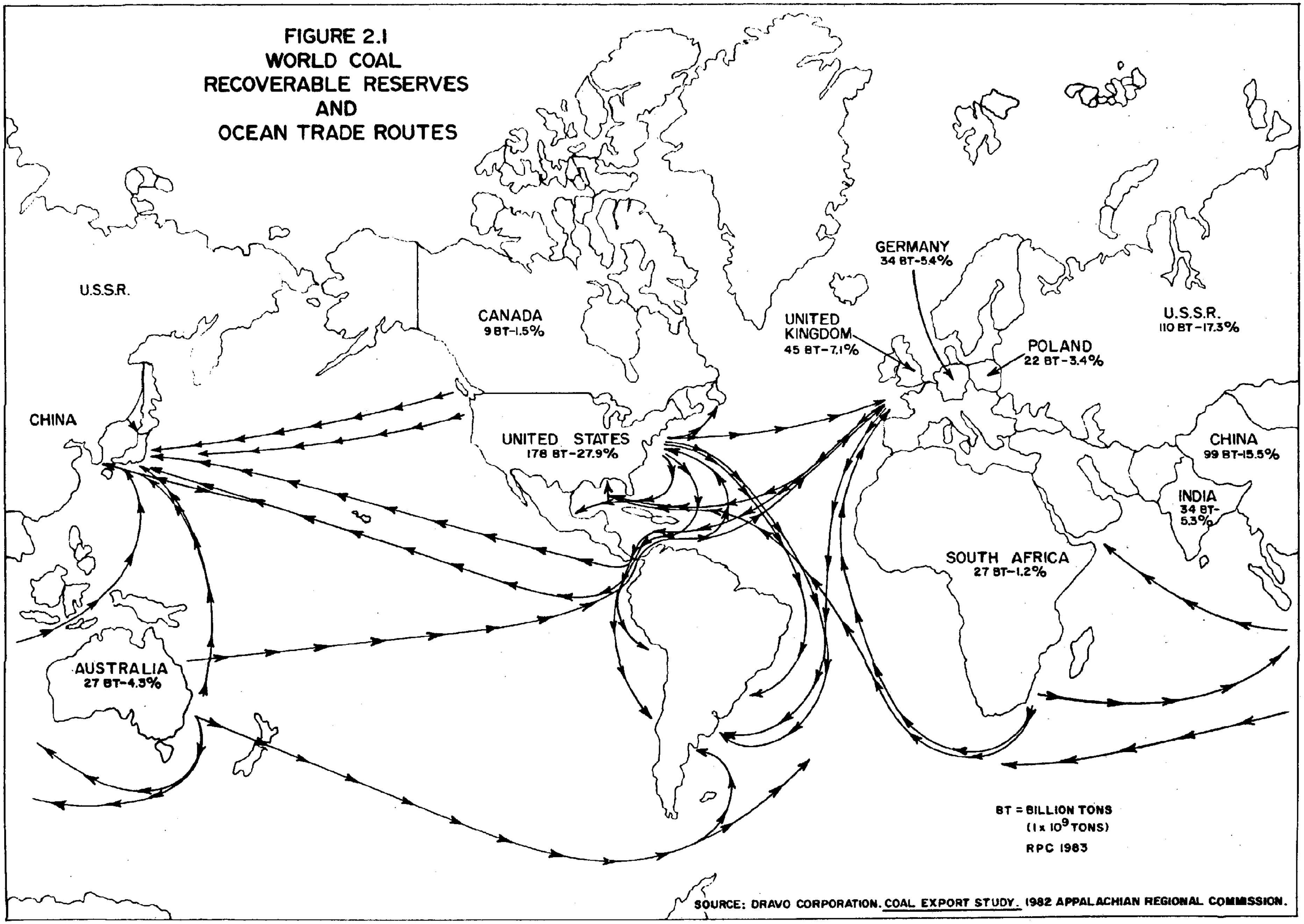


FIGURE 2.1
WORLD COAL
RECOVERABLE RESERVES
AND
OCEAN TRADE ROUTES

SOURCE: DRAVO CORPORATION. COAL EXPORT STUDY. 1982 APPALACHIAN REGIONAL COMMISSION.

TABLE 2.1 COAL EXPORT, 1972-1982
United States and Baltimore
(millions of short tons)

Years	United States	Baltimore	Percent Baltimore
1972	55.9	3.7	6.7
1973	53.0	4.4	8.3
1974	61.6	6.0	9.7
1975	65.3	6.8	10.4
1976	59.7	6.5	10.9
1977	53.9	7.0	13.1
1978	40.3	5.9	14.6
1979	45.6	9.1	20.0
1980	71.9	12.4	17.2
1981	96.0	13.0	13.5
1982	89.2	11.7	13.1

SOURCE: 1972-1979, United States Army Corps of Engineers. 1980-1982, Department of Commerce and Maryland Port Administration.

FIGURE 2.2
COAL EXPORTS U.S. AND BALTIMORE—1972—'81
(MILLIONS OF SHORT TONS)

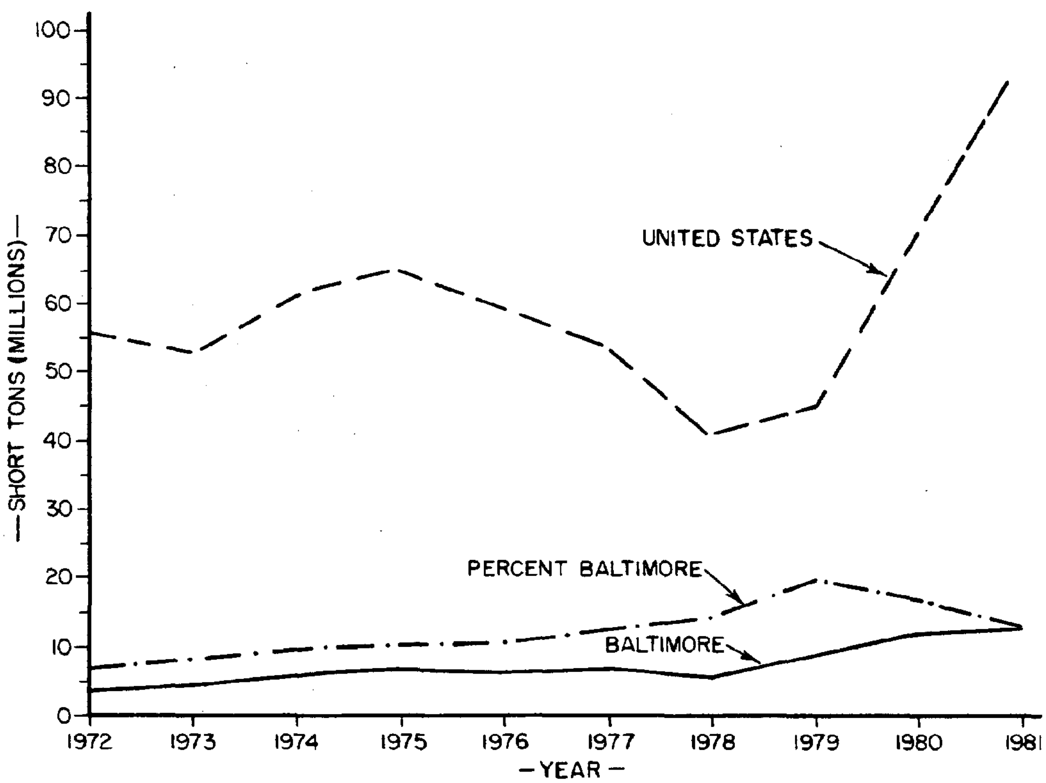


TABLE 2.2 UNITED STATES EXPORTS BY PORT OF EXIT, 1979-1982
(millions of short tons)

	1979		1980		1981		1982	
Port of Exit	Tons	Pct. of Total	Tons	Pct. of Total	Tons	Pct. of Total	Tons	Pct. of Total
Baltimore	9.1	19.9	12.4	17.2	13.0	13.7	11.7	13.1
Hampton Roads	33.2	72.8	51.7	71.9	52.0	55.0	57.8	64.8
Mobile	1.3	2.9	2.5	3.5	3.4	3.6	4.2	4.7
New Orleans	1.4	3.1	3.5	4.9	9.0	9.5	4.8	5.4
Philadelphia	0.6	1.3	1.6	2.2	2.9	3.1	1.9	2.1
Los Angeles	--	--	--	--	3.0	3.2	1.9	2.1
Long Beach	--	--	--	--	2.2	2.3	0.9	1.0
Baton Rouge	--	--	--	--	2.8	3.0	2.6	2.9
New York	--	--	--	--	1.7	1.8	0.3	0.4
Buford	--	--	--	--	2.4	2.5	0.3	0.4
Other	--	--	.2	.3	2.2	2.3	2.8	3.1
Total	45.6	100.0	71.9	100.0	94.6	100.0	89.2	100.0

SOURCE: 1979, United States Army Corps of Engineers. 1980 - 1982, Department of Commerce

The specific characteristics of the Baltimore coal traffic are given in Tables 2.3, 2.4 and 2.5. Table 2.3 shows the split between metallurgical and steam coal over the last 3 years. Although the volume of met coal still exceeds the volume of steam coal, the difference between the two has narrowed. In the future, as will be discussed in the next section, steam coal exports are expected to greatly exceed met coal exports.

The Port of Baltimore's coal exports by area of destination over the last 10 years are broken down in Table 2.4. Historically, Baltimore's major coal customer has been Japan, accounting for approximately 58 percent of the total volume from 1972-1979. Europe and the Mediterranean area and South America received 37 and 4 percent, respectively, of the total over the same time period. In the past 3 years, however, as a result of the growth in the steam coal traffic, these relationships have been reversed. The Far East received 37 percent of the combined 1980-82 volumes of coal exports, while Europe and the Mediterranean were the recipients of 60 percent. Table 2.5 provides more detail as to the destination of the steam coal exports during 1981 and 1982. Of the major importing countries, only one, Taiwan, was not in the European or Mediterranean areas.

Baltimore and Hampton Roads terminals are closer to both the coal mines and the major European markets than most U.S. ports, giving them the opportunity to offer better prices for export. Figure 2.3 illustrates the relative positions of mines, railroads and ports, giving the number of tons exported by each in 1981. The addition of new terminals since 1982 at both Baltimore and Hampton Roads may allow them to reestablish the lost market share when total coal exports increase.

COAL EXPORT PROJECTIONS - UNITED STATES

Recently, several studies have been published which indicate a continuation of the steam coal export boom which began in 1980. The principal studies are: The World Coal Study, headed by Dr. Carrol L. Wilson of M.I.T. in Cambridge, Massachusetts, and published in the Spring of 1980; a United States Government sponsored Interagency Coal Export Task Force released as an interim report in January of 1981; an ICF study entitled, Potential Role of Appalachian Producers in the Steam Coal Export Market, International Steam Coal Trade Analysis, prepared for the Appalachian Regional Commission and published in November of 1981; and a National Coal Association projection

TABLE 2.3 PORT OF BALTIMORE COAL EXPORTS BY TYPE
(Millions of Short Tons)

Type	1979	1980	1981
Metallurgical	7.1	8.1	7.3
Steam	2.0	4.3	5.3
Total	9.1	12.4	12.6

SOURCES: 1979, United States Army Corps of Engineers. 1980-1981, Chessie (B & O railroad).

TABLE 2.4 BALTIMORE COAL EXPORTS BY TRADE AREA, 1972-1981
(Thousands of Short Tons)

Year	Far East	Europe and Mediterranean	South America	Other	Total
1972	2,285	1,188	194	88	3,755
1973	2,684	1,424	189	109	4,406
1974	4,046	1,767	109	55	5,977
1975	5,254	1,105	340	59	6,758
1976	3,786	2,384	339	27	6,536
1977	3,527	3,167	360	--	7,054
1978	2,960	2,738	148	41	5,887
1979	4,151	4,513	465	12	9,141
1980	4,333	7,454	208	391	12,386
1981	4,393	8,342	143	91	12,969
1982	4,996	6,509	108	134	11,747

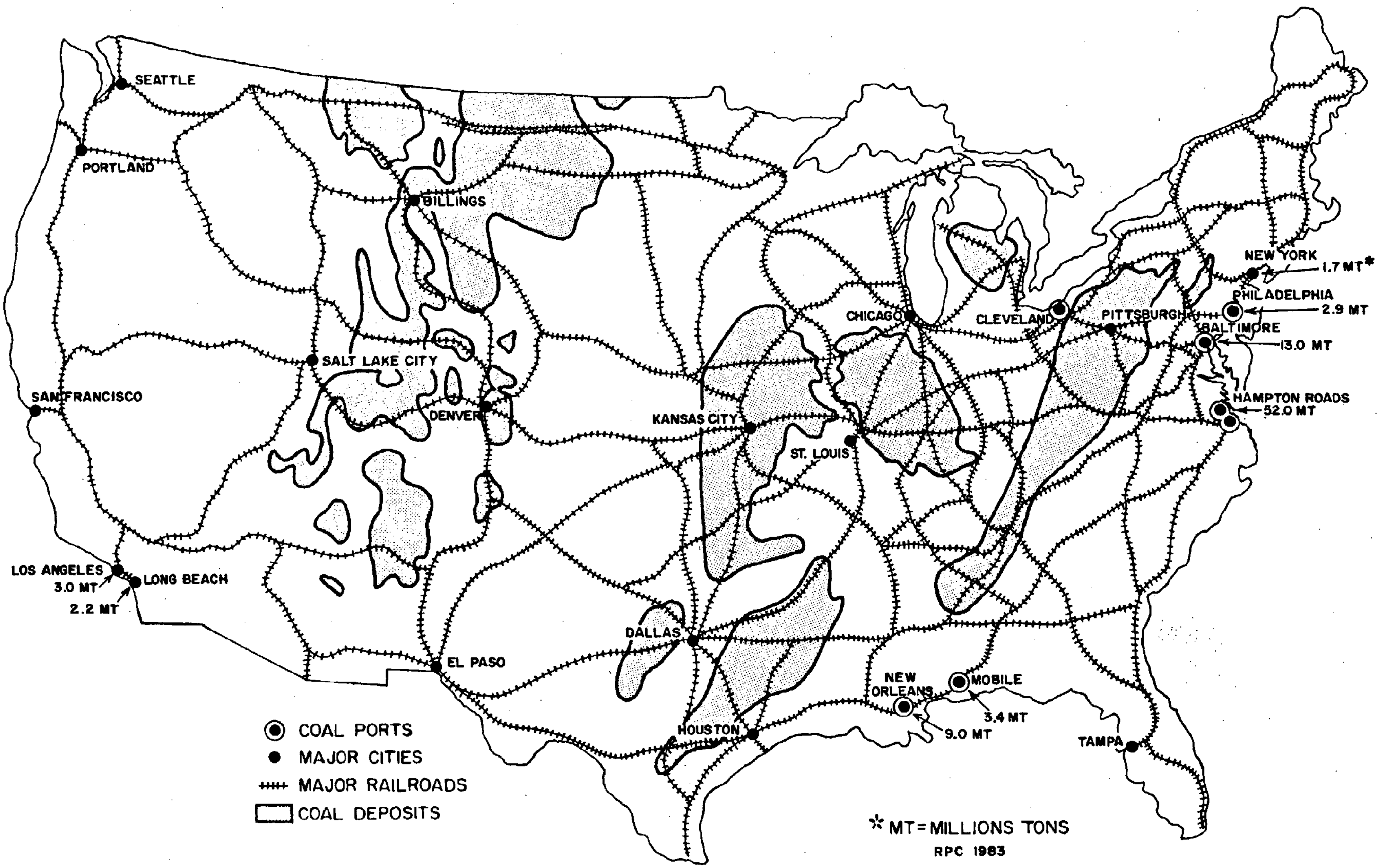
SOURCES: 1972-1979, United States Army Corps of Engineers. 1980-1981, Maryland Port Administration.

TABLE 2.5 PORT OF BALTIMORE STEAM COAL EXPORTS BY DESTINATION
(Thousands of Short Tons)

Country	1980	1981
France	1,830	1,649
Germany	576	922
Belgium	521	762
Netherlands	192	737
Denmark	0	411
Italy	319	340
Spain	28	198
Sweden	0	61
Taiwan	129	127
Others	675	129
Total	4,270	5,336

SOURCE: Chessie (B. & O. Railroad).

FIGURE 2.3
MAJOR UNITED STATES COAL DEPOSITS,
TRANSPORTATION SYSTEM, AND COAL PORTS
(INCLUDING TONS EXPORTED IN 1981)



SOURCE: DRAVO CORPORATION. COAL EXPORT STUDY. 1982 APPALACHIAN REGIONAL COMMISSION.

released in January of 1981 and updated in March of 1982. Each of these forecasts are described below.

The World Coal Study (WOCOL)

The World Coal Study is an exhaustive study by representatives from 16 major coal-using and coal-producing countries assessing all aspects of coal supply and demand over the next two decades. WOCOL concluded that world steam coal trade will need to increase by 10-15 times over the next 20 years to satisfy projected demand, and that the United States is the only nation capable of exporting more than 200 million tons by year 2000.

WOCOL'S projections (summarized in Table 2.6 and Figure 2.4) estimated coal use and infrastructure requirements, using two scenarios and one "extreme" case. The first scenario, or Case A, postulates a moderate increase in coal demand to year 2000 (yielding a 144 ton export volume). The second scenario, Case B, assumes a high increase in coal demand, one which would increase world coal supply, trade, and use to what would appear to be close to feasible upper limits (230 tons exported by the year 2000). Case B is also seen as a response to severe oil supply limitations and delayed expansion of nuclear power.

The estimates of total coal uses, and hence exports, in Cases A and B were developed through an analysis of market sectors (electrical, metallurgical, industrial, residential/commercial, and synthetic fuel) within each participating country. The primary difference between the projections of each scenario involves a large increase in the demand for steam coal in Case B, metallurgical demand remaining roughly equal for both scenarios. The export figure indicated for the "extreme" scenario (402.5 tons) represents a volume which is greater than what coal exporters expect to supply, but which is considered the maximum feasible alternative should world demand develop soon enough.

Interagency Coal Export Task Force (ICE)

The Federal Interagency Coal Export Task Force was formed at the direction of President Carter in the Spring of 1980, and was comprised of representatives from fourteen federal departments and agencies. The Interim Report of the Interagency Coal Export Task Force projected United States

TABLE 2.6 WOCOL UNITED STATES COAL EXPORT PROJECTIONS[1]
(Millions of Short Tons)

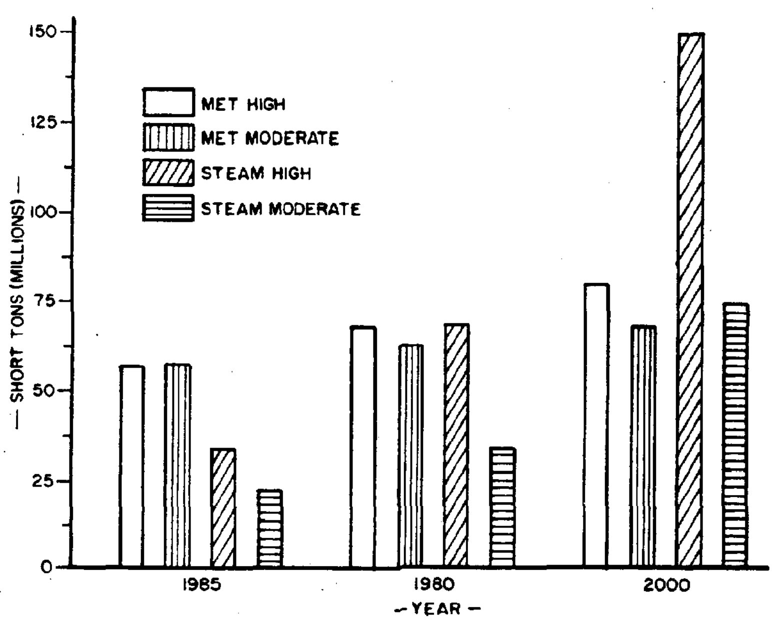
	1985		1990		2000		
	A	B	A	B	A	B	MAX
Met	57.5	57.5	63.2	69.0	69.0	80.5	
Steam	23.0	34.5	34.5	69.0	74.8	149.5	
Total	80.5	92.0	97.7	138.0	143.8	230.0	402.5

SOURCE: WOCOL study.

WHERE: Case A = moderate increase in coal demand.
Case B = high increase in coal demand.
MAX = Estimated Maximum Potential ("extreme" case).

[1]Tonnage figures for coal in the World Coal Study are usually given in metric tons of coal equivalent (Mtce) defined as a metric ton of coal with a specific heating value of 12,600 BTU/lb. Conversion to "short tons", which is the usual physical unit for shipments within the United States, requires a combined conversion multiple of 1.15.

FIGURE 2.4
U.S. COAL EXPORT PROJECTIONS—WOCOL
(MILLIONS OF SHORT TONS)



exports to the primary demand areas of the world, Europe and the Far East, of steam coal only. For the period 1985-1990, these projections are roughly 20 percent higher than those presented by WOCOL; and for the year 2000 they lie within the high range of such projections. The primary reason for higher projected growth in world coal consumption is the (then) escalating price of petroleum, the apparent undependability of its supply, and the resulting need to convert to other fuels for reliable generation of electricity and industrial process heat.

The United States export share of the growth in world steam coal trade is postulated as depending on the buying strategies of the consuming countries, the policies and prices of competing exporters, and the actions taken by the United States to maintain reasonable prices, prompt delivery and dependable quality. Although the United States has the highest delivered prices of coal to both Europe and the Pacific Rim, ICE believes that the United States' market share will not turn entirely on a lowest-delivered-cost criterion. Rather, because of the lessons learned from the unstable energy markets of the last decade, basic purchasing strategies for importing countries will emphasize security of supply and diversification of supply sources. This basic policy will hold, according to ICE, as long as competing delivered-coal prices lie within an acceptable tolerance (estimated as being on the order of 10 percent of the lowest delivered cost).

According to ICE projections of the United States' market share, (see Table 2.7) Europe will be the major destination for United States steam coal, reaching 145 million tons, or 47 percent of total European inputs by the year 2000. For the Pacific Rim Area, substantial volumes of steam coal exports are not expected until sometime after 1985. By year 2000, the United States is expected to supply 52 million tons or 25 percent of the Asian import market.

National Coal Association (NCA)

The National Coal Association's coal export projections are based on assumed variations in the level of demand, exports of other countries, and other variables that determine the competitiveness of United States coal, such as price and the capacity of port facilities.

Three different levels of exports are forecasted by NCA corresponding to different assumptions of relevant variables (see Table 2.8 and Figures 2.5 and

TABLE 2.7 ICE PROJECTED UNITED STATES SHARE OF THE WORLD STEAM COAL MARKET[1]

	Percent			Millions of Short Tons		
	1985	1990	2000	1985	1990	2000
Europe	28	29	47	28	49	145
Pacific Rim	minimal	17	25	minimal	15	52
Total	18	25	38	29	64	197

[1]Assumptions underlying the projections are as follows:

a. The overall worldwide data are the Task Force Projections. The assuptions listed below regarding South African, Australian, and Canadian distribution of exports between Europe and the Pacific Rim are considered reasonable extentions of current market factors, but are provided as working hypothesis only.

b. Poland will continue steam coal exports to Europe at the 1979 level.

c. South Afica will ship 50 percent of its coal to Europe; 50 percent to the Pacific Rim.

d. Australia will ship 80 percent of its steam coal to the Pacific Rim; 20 percent to Europe.

e. Canada will ship almost all of its coal to European buyers.

TABLE 2.8 NATIONAL COAL ASSOCIATION UNITED STATES COAL EXPORT PROJECTIONS[1] (Millions of Short Tons)

	1985			1990			1995		
	Low	Most Likely	High	Low	Most Likely	High	Low	Most Likely	High
Steam	35	45	56	54	66	79	72	98	125
Met	40	44	49	47	54	61	47	55	64
Total	75	89	105	101	120	140	119	153	189

[1]Excludes Canada

FIGURE 2.5
NATIONAL COAL ASSN.-U.S. MET COAL PROJECTIONS
(MILLIONS OF SHORT TONS)

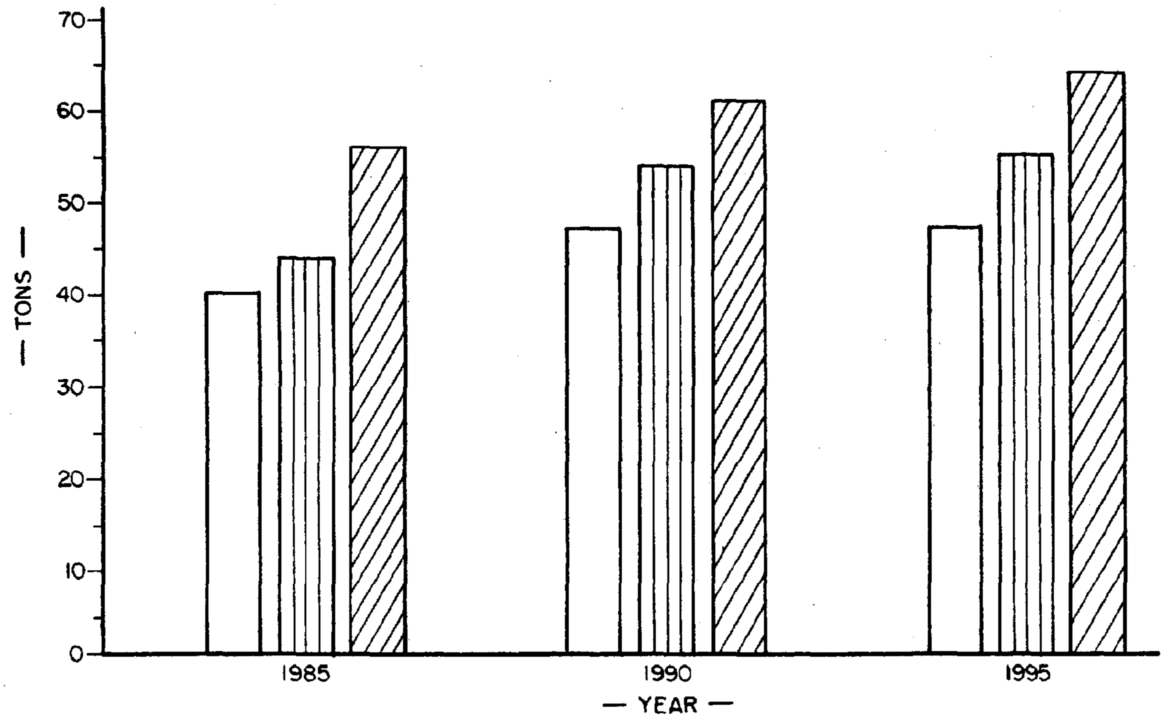
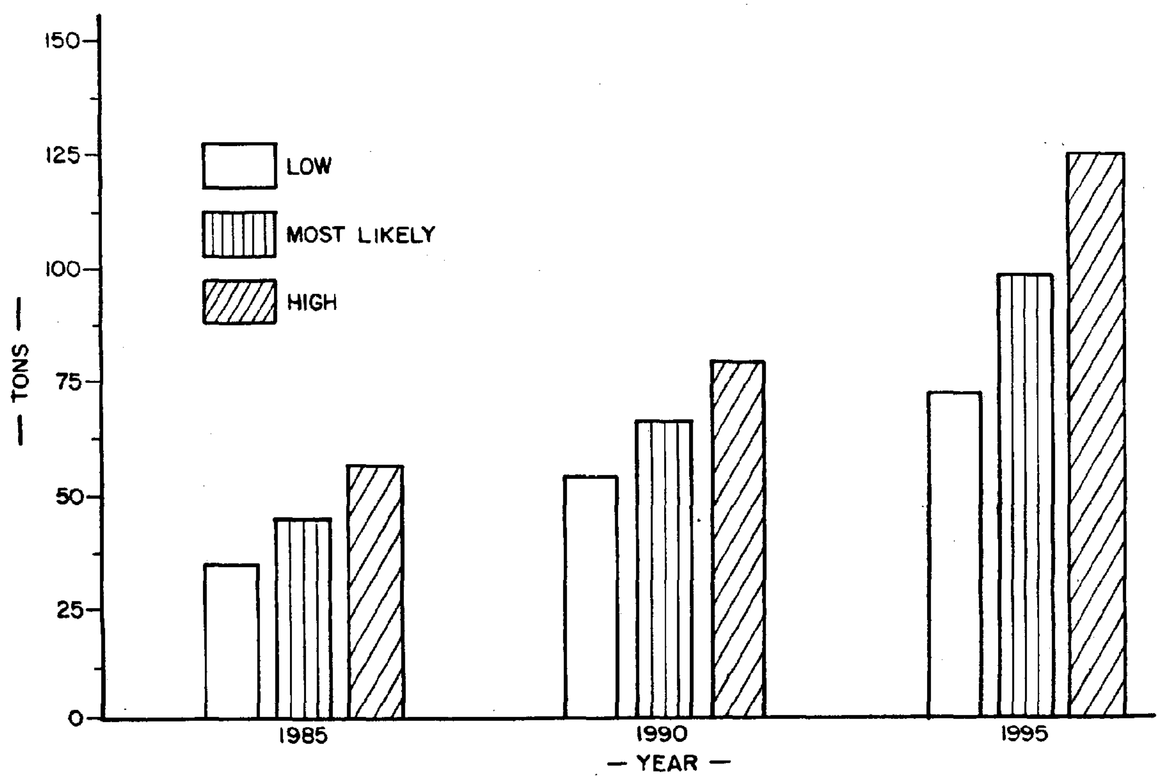


FIGURE 2.6
NATIONAL COAL ASSN.-U.S. STEAM COAL PROJECTIONS
(MILLIONS OF SHORT TONS)



2.6). The most likely forecast assumes demand growing at recent historical rates, improved transportation capabilities in the United States including dredging of two ports, and increases in oil and gas prices above the overall inflation rate.

The low forecast assumes lower levels of energy demand, less favorable factors affecting United States competitiveness (including higher transportation costs and no initiatives on dredging United States harbors) and greater restrictions on the use of coal.

The high forecast assumes higher levels of demand, increases in oil and gas prices, competitive cost of production for the United States coal, and a lower level of exports from other countries.

As with the two previous forecasts, total United States exports are projected to increase substantially, more than doubling between 1985 and 2000. Metallurgical coal exports, on the other hand, are expected to remain at current levels, the "most likely" case for 1995 of 55 million tons being slightly less than the 57 million tons exported in 1981.

ICF

The ICF report, which completed the first task of a four-task effort for the Appalachian Regional Commission on the role of Appalachia in the world steam coal market, forecasted world steam coal import demand for 1985, 1990, and 1995 for the major coal-using countries in Europe and the Pacific Rim, and the allocation of this demand among major coal exporting countries. The import demands were derived from country-by-country assessments of gross domestic steam coal requirements in the electric utility and non-utility sectors of the coal importing countries, less domestic production, if any. Market share forecasts for coal exporting countries were developed from analyses of delivered cost competitiveness, and from evaluation of several non-economic factors. These included consumer preferences for diversity of supply, producer market strategies, port and productive capacity constraints, and political considerations.

In its report, ICF concluded that the United States and Canada are the high cost suppliers in both Europe and Japan. South Africa would be the low cost supplier to Europe, while Australia would be the low cost supplier to the

Pacific Rim area. As a result of their favorable cost advantage, these two countries could rapidly expand their exports and become the predominant world suppliers of steam coal. However, according to ICF, there is a significant economic incentive for both Australia and South Africa to pursue market strategies which allow the United States to capture some portion of the world market, thereby strongly influencing or establishing the market clearing price for steam coal in world markets. This potential difference in delivered cost (not price) is shown for 1990 in Table 2.9.

The economic rents available to Australia and South Africa from these cost differentials are quite high. The governments of these countries have in the past, and can be expected in the future, to capture some of the available rent through a number of mechanisms--including charging high (i.e., above full cost) rates for rail transportation and port facilities, since these are owned by state and federal governments. Also, export levies, or "super royalties" have been applied by Australia in the past and can be expected to be used in the future.

Thus, a key issue in ICF's analysis is whether South Africa and Australia will be able to control the level of exports or reduce competition in order to allow the United States to establish the market clearing price. Given South Africa's concern about domestic energy supplies, and its existing quota system, ICF concluded that it seems likely that South Africa would be able to pursue a strategy to limit its exports. Australia is seen as a different case, and is the biggest uncertainty in developing forecasts of market shares in the world steam coal trade.

The ICF analysis provided three forecasts of the potential United States share of the steam coal market in Western Europe for 1985, 1990 and 1995. They include a "best guess" case, and two alternative cases designed to demonstrate the sensitivity of the forecasts to those key assumptions which are most uncertain. These assumptions are:

- potential production and export constraints for Australia and South Africa;
- different market share strategies for Australia and South Africa in Western Europe and the Pacific Rim; and
- expected levels of exports from minor supply countries, including Columbia, Poland, China, U.S.S.R.,and others.

TABLE 2.9 POTENTIAL ECONOMIC RENTS FOR SOUTH AFRICA AND AUSTRALIA: U. S. SETTING THE MARKET CLEARING PRICE IN 1990 (1981 \$/sst[1])

	U. S. Market Clearing Price	Delivered Cost	Potential Economic Rent
To Western Europe			
South Africa	\$67	\$46	\$21
Australia			
NSW	\$67	\$50	\$17
Queensland	\$67	\$53	\$14
To Japan			
South Africa	\$64	\$47	\$17
Australia			
NSW	\$64	\$37	\$27
Queensland	\$64	\$39	\$25

[1]Standard Short Ton.

SOURCE: ICF report.

In the "best guess" scenario, the United States is expected to capture about 27 percent of the steam coal market in Western Europe in 1985 and 1990; declining slightly to 25 percent of the market in 1995 (see Table 2.10). Note that there is a large difference between the low and high cases. Table 2.11 depicts United States coal export projections to the Pacific Rim.

It should be pointed out that the cases developed by ICF do not represent low and high cases for the United States steam coal exports as a whole--but were specifically designed to address the interrelationship between supplier strategies in the Pacific Rim markets with those in the West European markets. They do represent low and high cases to Western Europe. Hence, export tonnages and market shares depicted for the Pacific Rim area do not correspond to high-low scenarios for that market, but only for the Western European market.

COMPARISON OF UNITED STATES PROJECTIONS

For a variety of reasons, it is extremely difficult to directly compare the coal export projections from the four studies discussed above. The most important differences between these reports relate to the various levels of geographical detail, alternate years of projection, and several different units of measure. It is possible, however, to make rough comparisons between the different export projections. Tables 2.12, 2.13, and 2.14 list the United States steam coal export projections for the different studies by area of destination.

The ICF/ARC and ICE projections of United States steam coal exports to Europe are approximately equal for the years 1985 and 1990 (see Table 2.12). It should be pointed out that all of the ICF/ARC tonnage figures are in "standard short tons," (as opposed to short tons) which is a unit of measurement developed by ICF to account for the different heating qualities of coal by standardizing to a common heat content; in this case one million standard short tons represent 24 x 10^{12} BTU of coal. (The WOCOL study also standardized its metric ton figures to a specific heating value, 27.76 x 10^{12} BTU per million metric tons.) The differences in the ICF/ARC and ICE tonnage figures resulting from the different units of measure are probably quite small.

TABLE 2.10 FORECAST OF U. S. MARKET SHARE IN WESTERN EUROPE FOR STEAM COAL TRADE

Forecast	1985 MSST[1]	1985 Market Share	1990 MSST	1990 Market Share	1995 MSST	1995 Market Share
Best Guess	28	27%	48	27%	64	25%
Low	19	19%	27	15%	38	15%
High	44	43%	71	40%	96	37%

[1] (Millions of Short Tons) assumes 24 million BTU per short ton.

Source: ICF report.

TABLE 2.11 FORECAST OF U. S. MARKET SHARE IN PACIFIC RIM FOR STEAM COAL TRADE

Forecast[1]	1985 MSST[2]	1985 Market Share	1990 MSST	1990 Market Share	1995 MSST	1995 Market Share
Best Guess	8	14	23	20	48	24
Low	13	22	22	19	55	27
High	6	10	22	19	60	30

[1] Corresponds to the "low" and "high" cases for the Western European Market.

[2] Millions of Standard Short Tons.

Source: ICF report.

TABLE 2.12 COMPARISONS OF U. S. STEAM COAL EXPORT PROJECTIONS - EUROPE

Study	1985	1990	1995	2000
ICF/ARC[1]	28	48	64	--
ICE[2]	28	49	--	145
WOCOL[3]				25-83

[1]Millions of standard short tons (see text), representing "best guess" case.

[2]Millions of short tons.

[3]Millions of short tons, representing range of low and high case only, max case was reported as steam and met coal volumes combined.

The ICF/ARC projections for United States steam coal exports to the Pacific Rim Area predict a larger United States coal trade to this area than does ICE for the years 1985 and 1990 (see Table 2.13). For year 2000, ICE and WOCOL ("high" export scenario) are roughly equivalent (52-54 tons), although WOCOL'S tonnage figures are for Japan only.

For 1985, figures for total projected United States steam coal tonnages range from 23 (WOCOL low export scenario) to 45 (NCA "most likely" scenario) million tons (see Table 2.14). For 1990, ICF expects the most tonnage (76 tons), with WOCOL projections again being the lowest. (It should be kept in mind that WOCOL totals include Canada, which probably account for 5-12 million tons a year of steam coal exports.)

Only two studies have projections for 1995, ICF/ARC (117 million tons) and NCA (98 million tons); and two for year 2000, ICE (197 million tons, and WOCOL (74-149 million tons).

COAL EXPORT PROJECTIONS-THE PORT OF BALTIMORE

WOCOL Study

ICE, NCA, and ICF made no attempts to allocate United States coal exports to individual ports. However, WOCOL, in its second volume, Future Coal Prospects, made an analysis of expected port traffic based on the origins and type of coal, and on the expected physical limitations of individual ports. In allocating projected tonnages through ports, Baltimore is viewed as not sharing in, to any great extent, the expected export coal boom. Projected tonnages for the port for the year 2000 are forecasted as 13 million tons (Case A), 16 million tons (Case B) or 19 million tons (extreme case). The reasons given for Baltimore's low share include:

- Most of the coal currently handled by Baltimore is metallurgical and therefore, the port would not benefit by an increase in steam coal.
- Little chance of success is given for harbor deepening (which would increase the maximum vessel size able to serve the port and thereby lower the cost of transportation on some routes), due to opposition by environmental groups.

TABLE 2.13 COMPARISONS OF U. S. STEAM COAL EXPORT PROJECTIONS - PACIFIC RIM

Study	1985	1990	1995	2000
ICF/ARC[1]	8	23	48	--
ICE[2]	Minimal	15	--	52
WOCOL[3]				33-54

[1]Millions of standard short tons (see text), representing "best guess" case.

[2]Millions of short tons.

[3]Millions of short tons, low and high cases, for Japan only.

TABLE 2.14 COMPARISONS OF U. S. STEAM COAL EXPORT PROJECTIONS - TOTAL

Study	1985	1990	1995	2000
ICF/ARC[1]	38	76	117	--
ICE[2]	29	64	--	197
WOCOL[3]	23-34	34-69		74-149
NCA[4]	45	66	98	

[1]Millions of standard short tons (see text), representing "best guess" case; excludes Canada.

[2]Millions of short tons; Europe and Pacific Rim only.

[3]Millions of short tons, range of low and high cases; includes Canada.

[4]Millions of short tons; represents "most likely" case, excludes Canada.

- As exports are expanded, increasingly significant amounts of coal must be shipped from the Illinois Basin (Midwest) and Western United States origins.

Hampton Roads, the lower Mississippi (i.e. the New Orleans area), and west coast ports (yet to be developed) are seen as the big gainers of increased coal traffic.

United States Army Corps Of Engineers

The United States Army Corps of Engineers, Baltimore District, recently published coal export projections for the Port of Baltimore as part of its cost-benefit analysis of the proposed harbor and channel deepening from 42 to 50 feet. The Corps used the ICE national export figures as a basis for their calculations and used three different methods to derive port projections. The first method assumed that the Port of Baltimore would have approximately 20 percent of total United States effective coal export capacity, and thus allocated 20 percent of total United States projected tonnage to Baltimore.

The second method allocated the United States projected total by world area of destination and United States coastal area based on competitive factors. Here, the Corps assumed that two-thirds of the projected U. S. steam coal exports to Europe would originate on the East Coast, and that half of the total would originate from Baltimore.

The third method for deriving Baltimore's future coal export volumes involved estimating a percent utilization factor of planned export capacity in the port. By taking into account percent of planned capacity which is committed by long-term contracts to European buyers, the Corps estimated that a 75 percent utilization factor of the new coal export capacity for Baltimore (seen as being 55 million tons a year) will be attained by the year 2000.

The three methods described above for determining future steam coal export volumes from Baltimore all gave comparable results, ranging from 42 to 48 million tons (year 2000). The mid-point of the range, 45 million tons, was selected as the best projection of Baltimore's steam coal exports, all of which are to go to Europe. Export volumes for 1986 were estimated at 30 million tons.

Metallurgical coal exports from Baltimore were estimated based on a WOCOL projection of a 1.4 to 2.0 percent annual increase in total United States met exports. Using the 1.4 percent growth rate, Baltimore's metallurgical coal exports were estimated to increase to 9.8 million tons by year 2000. Table 2.15 lists the projected steam and metallurgical coal exports from Baltimore by area of destination for the years 1986 and 2000.

ANALYSIS OF PORT OF BALTIMORE PROJECTIONS

From a present-day perspective, it appears that the coal export projections for the Port of Baltimore by the WOCOL study are too low, while those from the Corps of Engineers are too high. Taking the WOCOL study first, the following comments can be made on their reasons for allocating such a small share of projected national coal exports to Baltimore:

- Most of the past shipments of coal through the port have been met coal since that is what was demanded by foreign buyers. As mentioned previously, the nation's export of coal was almost entirely metallurgical until 1979. In other words, the type of coal exported in the past cannot be used as an indication of the type of coal which is to be exported in the future.

- The proposed project to dredge the harbor and channels to 50 feet has finally persevered, after 10 years, over the strong opposition by environmental groups. However, a new impasse has developed between the State of Maryland and the federal government over the sharing of the costs of the project. Still, the Port of Baltimore is the only port to have been authorized to dredge to 50 feet and is further along in achieving that goal than any other United States port.

- Although it is true that increasing amounts of export coal will originate in the Midwest or Western regions of the United States, substantial reserves of billions of tons of recoverable steam coal exist in the northern Appalachian region of Pennsylvania, Western Maryland and northern West Virginia. Additionally, these areas are already served by an established rail network (the Chessie and Conrail Systems), which serve the Port of Baltimore. Transportation systems and port infrastructures for coal export are presently lacking in many areas of the Midwest and West.

The Army Corps of Engineers coal export projections are based on the construction of a number of export facilities in the Port of Baltimore which they assumed would yield a total capacity of 55 million tons (see Table 2.16 for status of facilities). Since the publication of their analysis, the rate of growth in the world demand for steam coal has slackened to some extent due in part to the world-wide recession, an oil glut causing a real decline in oil

TABLE 2.15 PORT OF BALTIMORE COAL EXPORT PROJECTIONS
(Millions of Short Tons)

	1986			2000		
	Met	Steam	Total	Met	Steam	Total
Europe and Mediterranean	4.4	30.0	34.4	6.5	45.0	51.5
Far East	3.0	0.0	3.0	2.5	0.0	2.5
South America and Others	.6	0.0	0.6	0.8	0.0	0.8
Total	8.0	30.0	38.0	9.8	45.0	54.8

SOURCE: United States Army Corps of Engineers.

TABLE 2.16. EXISTING AND PROPOSED COAL EXPORT TERMINALS

Name	Location	Status	Completion Date[1]	Investment (Millions)	Serving Railroads	Annual Tonnage Million Tons)
Curtis Bay	Curtis Bay Baltimore City	Existing	1968	11	CSX	12 to 14
Island Creek	Curtis Bay Baltimore City	Operational	1983	60	CSX	12 to 15
Marley Neck	Marley Neck, Anne Arundel County	Deferred	1985	100	CSX	15 to 30
Consolidation Coal	Canton, Baltimore City	Operational	1983	110	CSX Con-Rail	10 to 20
Sparrows Point	Sparrows Point Baltimore County	Proposed	N/A	N/A	CSX Con-Rail	8 to 10

[1]Actual or latest construction estimates.

prices, and an end to the stock-piling of coal by foreign buyers. As a result of this decline in the rate of growth of coal exports, and a realization that if all of the proposed coal export terminals around the nation were actually built there would be a tremendous overcapacity (even under the best of scenarios) a number of proposed projects, nationwide, have either been cancelled or put on hold. In the Port of Baltimore, two projects today are seen as unlikely to be built; the Soros Associates terminal on Marley Neck, and the Sparrows Point terminal, adjacent to Bethlehem Steel. With the elimination of these two projects, and the completion of the Island Creek and Consolidation Coal piers, the coal export capacity of the port becomes approximately 32-35 million tons a year in the foreseeable future.

It is extremely difficult to estimate coal exports through a particular port far into the future. Two major variables have to be accurately taken into account: (1) total national exports and (2) the percent of total exports which would go through the port. Each one of these two variables has in turn numerous other influences which determine their values. The variables affecting total national exports, for instance, have been discussed in the previous sections and are largely political in nature, making them even harder to predict.[2] Port shares of coal cargo have not been discussed previously, but depend on, at a minimum, comparative rates of transportation from mine month to the port, congestion-caused delays, location of coal sources, distance to foreign ports and availability of alternative ports of exit. As far as the Port of Baltimore is concerned, many port projects are still under construction on the East and Gulf coasts which could directly affect its share of future coal traffic. These include:

- The expansion of pier 124 in Philadelphia from 3 million to 7 million tons annual capacity;
- Massey Coal's facilities at Newport News with 12 million tons of annual capacity and Charleston, South Carolina, planned for 2.5 million tons capacity;

[2]As an example, almost all of the studies assume Poland to play a relatively small role in the future in supplying Western Europe with steam coal. However, recently, driven by a desperate need for foreign currency, Poland has returned to the export market to sell coal at less than the cost of production.

- The expansion of McDuffie Island in Mobile from 5 million to 9 million annual tons;
- The expansion of two terminals in New Orleans raising annual capacity from 12 to 27 million tons.

Taking these and other port projects into account, Table 2.17 gives a summary of United States coal loading capacity, including projects already underway and planned for future construction. If just existing facilities currently are counted, a national capacity of 197 million tons a year would be available, enough to handle the largest coal export projection for the year 2000. Additionally, it is estimated that the Great Lakes ports, traditionally having sent their coal cargos only to Canada, have the potential capability to export 16.4 million tons per year through the St. Lawrence Seaway.

RPC PROJECTIONS - PORT OF BALTIMORE

Taking into account the expansion plans of other ports, Table 2.18 and Figure 2.7 present coal export projections for the Port of Baltimore for the years 1985, 1990, 1995, and 2000. The basis for the steam coal projections for 1985-1995 are the ICF/ARC national steam coal export projections for Europe. For year 2000, ICE and WOCOL estimates for United States steam coal exports to Europe are used. No steam coal exports to the Pacific Rim through the Port of Baltimore are projected. The met coal figures are taken from the Corps of Engineers projections which indicate a slow growth tied to world steel demand. Different scenario levels for met coal exports are not estimated.

In order to go from the projected national steam coal exports to Europe to the Port of Baltimore's share, estimates were made on the share of this traffic which will be captured by east coast ports, and the percent of this east coast volume which will pass through Baltimore. For 1985, it is assumed that 80 percent of United States steam coal exports bound for Europe will pass through east coast ports, and that 65 percent of this total for the "most likely" and "low" scenarios will pass through Baltimore. For the high scenario, only 50 percent is estimated to be captured by the Port of Baltimore, based on recent past experience of the willingness of purchasers to use alternate ports of exit in order to speed up delivery times. Coal export volumes through Baltimore are seen as being close to 20 million tons in 1985

TABLE 2.17 SUMMARY OF U. S. COAL LOADING CAPACITY
(Millions of Tons)

Coast	Terminal Capacity		
	Existing	Underway	Planned
East Coast	89.9	51.5	141.5
Gulf Coast	34.5	19.0	119.5
West Coast	3.0	--	81.7
Total	127.4	70.5	342.7

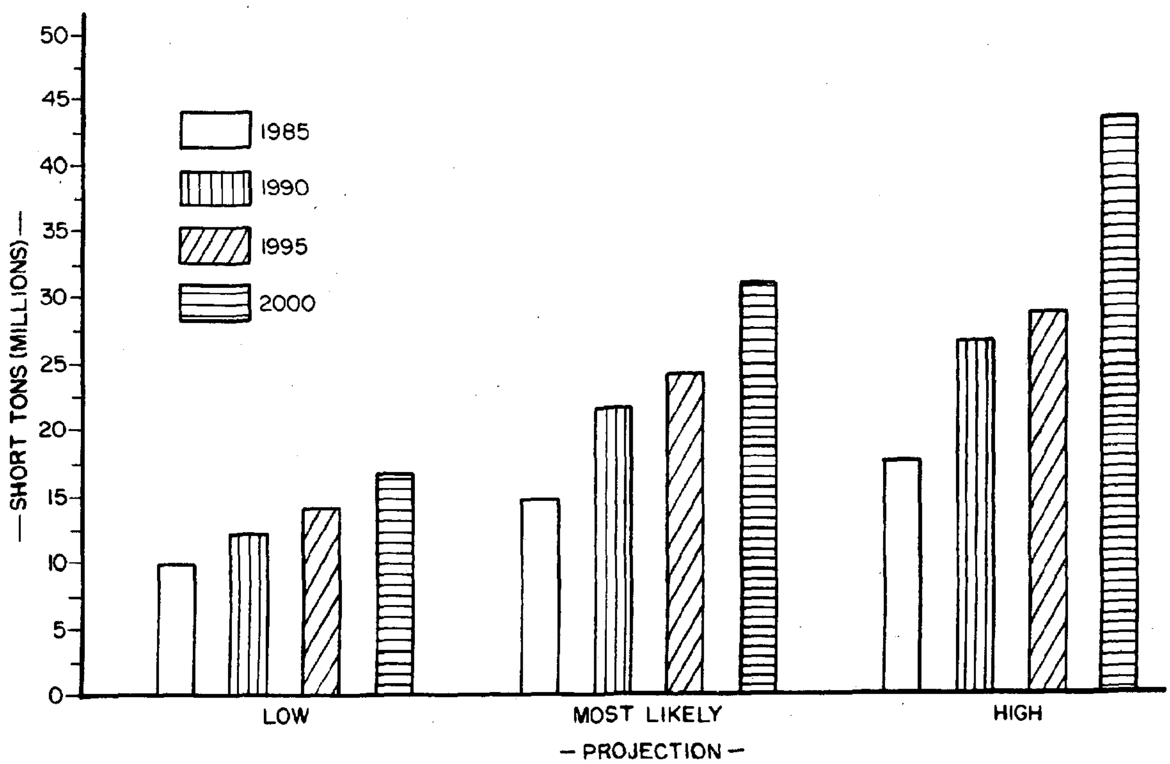
Source: Maritime Administration, U. S. Department of Transportation.

TABLE 2.18 PORT OF BALTIMORE COAL EXPORT PROJECTIONS

	1985			1990			1995			2000		
	Steam	Met	Total	Steam	Met	Total	Steam	Met	Total	Steam	Met	Total
Most Likely	14.6	5.0	19.6	21.6	5.9	27.5	24.0	6.6	30.6	31.1	7.3	37.7
Low	9.9	5.0	14.9	12.2	5.9	18.1	14.2	6.6	20.8	16.7	7.3	24.0
High	17.6	5.0	22.6	26.6	5.9	32.5	28.8	6.6	35.4	43.5	7.3	50.1

SOURCE: Regional Planning Council estimates.

FIGURE 2.7
BALTIMORE STEAM COAL EXPORT PROJECTIONS—RPC
(MILLIONS OF SHORT TONS)



(15 million tons of steam coal) with a low of 15 million tons, and a high of nearly 23 million tons.

For 1990, it is assumed that Gulf Coast Ports will begin to more actively participate in the coal export trade so that only 75 percent of European steam coal exports will be leaving from east coast ports. In addition, because of further pier construction along the east coast, Baltimore's share of east coast steam coal traffic is projected to decline to 60 percent for the "most likely" and "low" scenarios and 50 percent for the higher scenario. Hence a total tonnage of 27.5 million tons is estimated for 1990, with a range of 18 to 32 million tons.

For 1995 and 2000, east coast shares are projected to remain stable (75 percent) while Port of Baltimore shares drop to 50 percent for the "most likely" and "low" cases, 40 percent for the high scenario. Most likely coal exports for year 2000 are seen as reaching 38 million tons (31 million tons of steam coal) with a possible range of 24 to 50 million tons.

Under the "most likely" scenario, the existing Chessie (Curtis Bay) coal pier plus the two facilities recently completed appear to have enough potential capacity to handle coal volumes through the Port of Baltimore to the year 2000. If the "high" scenario becomes a reality, additional pier construction, such as the proposed Marley Neck and Sparrows Point facilities, would become necessary.

CHAPTER III
ECONOMIC IMPACT OF COAL EXPORTS

1980 DIRECT IMPACTS

Employment by occupation which directly resulted from the movement of coal through the Port of Baltimore in 1980 was prepared for the Greater Baltimore Committee by Booz, Allen and Hamilton, Inc. (BAH)[1]. These direct employment impacts are allocated to individual jurisdictions, and for the 1980 coal export tonnage of 12.5 million tons, are estimated under two different scenarios. The two different estimates were made because it was recognized that 1980 was an "abnormal" year in terms of coal movements, as the average time that a vessel waited to be loaded was approximately thirty days. In order to avoid overstating the long-term impacts of coal movements by using this lengthy loading period, direct employment estimates were also made under what was considered to be more steady-state conditions, in this case, an average time in port of about four days.

Under the thirty-day average loading time for 1980 coal exports, a total of 1,538 jobs in the Baltimore Metropolitan area were directly tied to the coal movements (see Table 3.1). If a more "reasonable" loading time (four days) had been the case in 1980, 127 fewer jobs (1,411 total) in the region could be directly related to the movement of the same 12.5 million tons. These two employment estimates represent 62 and 60 percent, respectively, of total estimated state employment directly related to the exportation of coal through the Port of Baltimore.

The differences in the two job impact estimates involve three different employment categories. The first or "barge-transshipment operations," was a temporary operation initiated in October of 1980 in order to reduce vessel waiting time (and the associated $15,000 per day demurrage charges). The barge-transshipment method involved the direct dumping of coal into barges at the Curtis Bay coal export facility and transshipment of the coal to waiting vessels at the Port Covington Ore Pier. At Port Covington, the coal was off-

[1]Economic Impacts of the Export of Coal through the Port of Baltimore. Booz, Allen and Hamilton, Inc. 1981. Greater Baltimore Committee.

TABLE 3.1 EMPLOYMENT IMPACTS IN THE BALTIMORE SMSA FROM COAL EXPORTS THROUGH THE PORT OF BALTIMORE, 1980

Employment Category	Number of Jobs 30-Day Queue	Number of Jobs Four-Day Queue
Railroad Workers	977	977
Barge Operators	51	-
Shipyards	50	50
Coal Terminal	177	177
Coal Testers	20	20
Towing	19	19
Pilots	7	7
Agents	22	22
Chandlers, Surveyors and Bunkering Firms	16	2
Local Service	152	102
Launch Crews	14	2
Government	19	19
Banks and Insurance	14	14
Totals	1,538	1,411

SOURCE: Booz Allen and Hamilton, Inc.

loaded from the barges onto the coal vessels via a floating crane, and a crane mounted on rail tracks on the ore pier. The use of this barge-transshipment system resulted in an additional cost in excess of the direct loading cost at the Curtis Bay facility and is seen as not being economically feasible when waiting times are significantly shorter. Therefore, all fifty-one jobs in the barge-transshipment operation are projected to be eliminated under more normal loading conditions.

Other affected employment categories include several members of the maritime service sector which are assumed to be sensitive to the length of time a vessel is in port. These include launch service firms and chandlers. BAH reestimated employment impacts in these two categories based on a lower number of total vessel days in port. In all, a total of twenty-six jobs in these service sectors were determined to be a direct result of the thirty-day vessel queue.

The impacts on the local service industries (i.e. restaurants, hotels, etc.) were also assumed to be dependent upon the length of time a vessel is in port. Here, BAH estimated reductions in crew spending resulting from fewer days in port, and then translated these reductions into affected jobs. It was estimated that fifty jobs in local service industries would be lost as a result of the reductions in crew spending.

THE BALTIMORE REGIONAL INPUT-OUTPUT MODEL

The jobs (and associated income) described in the previous section, which resulted from the movement of coal through the Port of Baltimore, are only part of the total economic impact. Besides these direct effects, impacts on firms which supply goods and services to firms supplying direct requirements, and impacts on firms providing goods and services to these secondarily-affected firms, ad infinitum, must also be considered. Additionally, a complete analysis would also account for "induced" effects, i.e. those effects resulting from increased consumer spending generated by wages and salaries in the coal-exporting sectors themselves, and by increased consumer spending generated by higher aggregate levels of wages and salaries in all indirectly affected activities. One way to measure this total (i.e. both direct, indirect, and induced) impact is with an "input-output" model of a regional economy which can capture the inter-industry relationships associated with the production and distribution of goods and services. The Regional Planning Council's Baltimore Regional Input-Output Model (BRIO) is just such a tool, designed to identify both direct, indirect, and induced consequences of specific economic activity.

At the heart of the BRIO model is a transactions matrix which details the purchases and sales of goods and services between industrial sectors (see Figure 3.1). The transactions matrix consists of 198 rows and columns, representing sectors existing in the Baltimore region. A number of required inputs are not available in the region, and to provide an accounting of such inputs, the matrix has 155 imput rows. Eleven wage and salary sectors are also included in the model along with fourteen "other" sectors (Land Factor Payment, Employee Fringe, Federal Taxes, etc.) that bring the total number of rows to 378.

Also included in the model are:

- An output vector which expresses the total dollar output of each sector in the Baltimore region.
- A column vector of trade coefficients which expresses the proportion of regional demand which is satisfied by regional production.
- A matrix of final demand. There are fifty-six columns in this matrix, one for each of the regional final demand sectors. These sectors consist of seven federal government sectors, forty-eight capital formation sectors and an export sector.
- A labor productivity vector which represents the ratio between output and employment in a given sector.

The input-output model can be summarized by the following equation:

$$X_i - \sum_j t_i A_{ij} X_j = \sum_k Y_{ik}$$

Where:

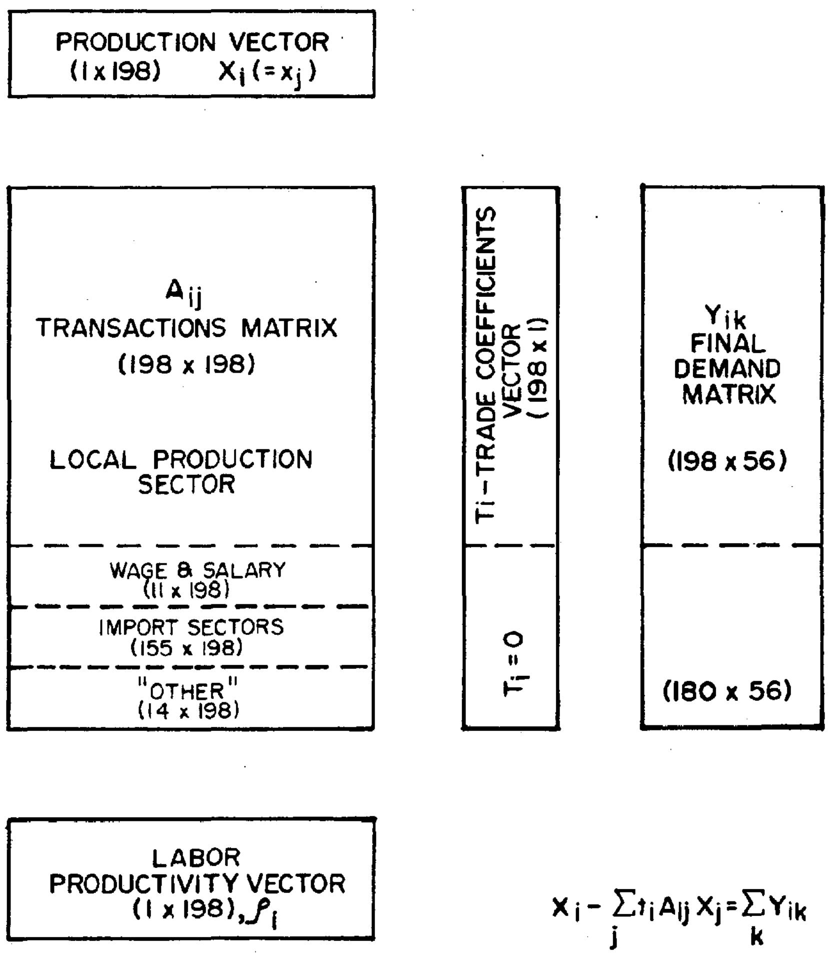
X_i = Output of sector <u>i</u>

t_i = trade coefficient for sector <u>i</u>

A_{ij} = the interindustry purchases, usually expressed as technical coefficients, i.e., the purchases from industry <u>i</u> which are necessary to produce a dollar's worth of output of industry <u>j</u>

Y_{ik} = final demand of sector <u>k</u> placed on processing sector <u>i</u>

FIGURE 3.1
MAJOR COMPONENTS OF THE BALTIMORE REGION INPUT-OUTPUT MODEL



$$X_i - \sum_j t_i A_{ij} X_j = \sum_k Y_{ik}$$

$$E_j = \rho_j X_j$$

Employment in the model may be represented by:

$$E_j = \ell_j X_j$$

Where:

X_j = total regional production, industry $\underline{j}$

ℓ_j = an output-to-employment ratio for sector $\underline{j}$

E_j = total employment in sector $\underline{j}$

Additional information about the model and how it was applied to produce the results which follow is detailed in Appendix A. This appendix also includes tables of detailed results of the thirty-day and four-day scenarios.

1980-TOTAL IMPACTS

The BRIO model was run using the data on employment presented in the last section, and associated final demand (discussed in Appendix A) to determine total economic impacts associated with 1980 coal export volumes. Two runs were made, one for each of the two different loading-day scenarios. For these conditions, indirect and induced impacts were distinguished from direct impacts.

There are significant additional employment and production impacts that can be associated with the movement of coal in the region under both the thirty-day and four day scenarios (see Tables 3.2 and 3.3). Under actual 1980 loading conditions (thirty-day scenario), 1,650 additional jobs in the region were generated from direct coal-related economic activity. If a four-day loading period had prevailed, a smaller but still substantial number of jobs would have been generated (1,460). Associated with these employment increases are increases in annual regional output amounting to $155 million (thirty-day scenario) and $138 million (four-day scenario).

At the bottom of each table are the regional production and employment multipliers. For instance, the regional production (output) multiplier of 3.0 indicates that for a one million dollar change in the output of sectors associated with coal exports, a total increase of $3.0 million (or an additional $2.0 million) in the output of the region's industries will occur. The employment multiplier of 2.1 in this case indicates that for every 100 additional jobs in the coal-exporting sectors of the regional economy there will be a total increase of 210 jobs (or an additional 110 jobs) in the Baltimore SMSA economy. Note that the multipliers for the two scenarios are roughly equal, there being primarily a difference in the amount of employment between them and not in the nature of that employment.

The regional production and employment figures shown in Tables 3.2 and 3.3 can be broken down into thirteen summary sectors (see Tables 3.4 and 3.5). These figures indicate that the biggest additional employment impacts are in the "Retail Trade" and "Personal, Business, and Other Services" sectors. This result is in keeping with the nature of the sectors which are directly associated with coal exports, i.e. service-oriented sectors whose primary inputs are labor. The wages paid to the employees in these sectors are then spent on consumer-oriented goods and services. Other sectors with substantial employment gains include "Transportation, Communication, and Utilities," "State and Local Government," and "Wholesale Trade." These sectors are oriented towards supplying businesses with the services needed to carry out their daily operations.

At first glance it appears that there is a small additional employment impact on the manufacturing sector. However, if the two sectors, "durable" and "nondurable" are combined, it becomes apparent that the gain to manufacturing is relatively large (approximately 130 employees under each scenario). The employment gain in durable manufacturing (70) is primarily due to the input requirements of the ship repairing sector, which draws heavily on specialty steel and metal products producers. Nondurable manufacturing employment gains (60) are mostly the result of the use of printing and publishing sectors by Business Services. (For a more complete listing of employment gains by individual sectors, see Appendix B.)

TABLE 3.2

COAL IMPACT TEST, 1980 COAL VOLUMES,
THIRTY-DAY LOADING TIME
(1983 Dollars)

Indirect and Induced Impacts	
Regional Production	$ 154.96 million
Employment	1,650 jobs
Total (Direct, Indirect and Induced) Impacts	
Regional Production	$ 231.42 million
Employment	3,190 jobs
Multipliers	
Regional Production	3.0
Regional Employment	2.1

TABLE 3.3

COAL IMPACT TEST, 1980 COAL VOLUMES,
FOUR-DAY LOADING TIME
(1983 Dollars)

Indirect and Induced Impacts	
Regional Production	$ 138.14 million
Employment	1,460 jobs
Total (Direct, Indirect and Induced) Impacts	
Regional Production	$ 203.88 million
Employment	2,870 jobs
Multipliers	
Regional Production	3.1
Regional Employment	2.0

TABLE 3.4

1980 COAL IMPACT TEST, 30-DAY SCENARIO
SECTORAL CHANGE IN REGIONAL PRODUCTION AND EMPLOYMENT*

	Change in Regional Production (1)		Change in Regional Employment	
	Additional**	Total***	Additional**	Total***
Agricultural Products And Services	$ .36	$ .36	--	--
Mining and Extraction	0.24	0.24	--	--
Construction	10.16	10.16	112	112
Nondurable Mfg.	7.21	7.21	61	61
Durable Mfg.	6.15	16.08	72	122
Transportation, Communication and Utilities	9.12	68.98	159	1,404
Wholesale Trade	8.17	8.17	143	143
Retail Trade	12.01	12.01	471	471
Finance, Insurance and Real Estate	9.10	10.06	88	102
Personal, Business and Other	12.79	17.98	338	548
State and Local Govt.	11.26	11.26	206	225
Wage and Salary/ Consumer Exp.	68.60	69.12	--	--
TOTAL	$155.17	$231.63	1,650	3,188

(1) Millions of 1983 Dollars.
* Totals may differ slightly from Table 3.2 due to rounding.
** Includes indirect and induced impacts.
*** Includes direct, indirect and induced impacts.

TABLE 3.5

1980 COAL IMPACT TEST, FOUR-DAY SCENARIO
SECTORAL CHANGE IN REGIONAL PRODUCTION AND EMPLOYMENT*

	Change in Regional Production (1)		Change in Regional Employment	
	Additional**	Total***	Additional**	Total***
Agricultural Products And Services	$ .32	$ .32	--	--
Mining and Extraction	0.0	0.0	--	--
Construction	8.35	8.35	89	89
Nondurable Mfg.	6.52	6.52	60	60
Durable Mfg.	5.19	15.13	70	120
Transportation, Communication and Utilities	7.88	58.54	137	1,319
Wholesale Trade	7.20	7.20	129	129
Retail Trade	10.85	10.85	418	418
Finance, Insurance and Real Estate	8.06	9.01	75	89
Personal, Business and Other	11.43	15.08	312	458
State and Local Govt.	9.91	9.91	170	189
Wage and Salary/ Consumer Exp.	62.44	62.97	--	--
TOTAL	$138.15	$203.88	1,460	2,871

(1) Millions of 1983 Dollars.
* Totals may differ slightly from Table 3.3 due to rounding.
** Includes indirect and induced impacts.
*** Includes direct, indirect and induced impacts.

Additional output gains, as with employment, are concentrated in the service-oriented sectors ("Personal, Business, and Other Services," "Retail Trade," and "State and Local Government"). Increases in a combined manufacturing sector, as well as the construction sector are also prominent. The gain in the construction sector is due primarily to the demand by the water transportation services sector.

ESTIMATED TOTAL IMPACTS FOR PROJECTED COAL EXPORTS

In the previous section, total economic impacts attributed to coal exports through the Port of Baltimore in 1980 were estimated. In the following sections, the same procedure will be used to estimate the economic impacts of various projected volumes of coal exports. The volumes of exports used in this analysis are taken from the end of Chapter II which dealt with RPC coal export projections for the Port of Baltimore. Basically, the "most likely" projected coal volumes are used for the years 1985, 1990, 1995, and 2000 in the economic analysis. Additionally, in order to obtain an upper bound for the economic impacts, the "high" scenario coal tonnage projection for year 2000 is also used.

Projected Direct Impacts

In estimating direct employment associated with future coal export volumes, it is necessary to make some generalized assumptions on the characteristics of the coal export trade. These assumptions, taken from the Booz Allen and Hamilton report, include:

- A discontinuation of the barge/transshipment operation.
- No major changes in fleet composition or vessel technology.
- The future average cargo size is estimated to be 61,600 short tons per vessel call, an increase of 7,840 short tons over the 1980 coal tonnage per vessel call.
- The average waiting/loading time in the future is estimated to be about ten days. This is based on a recently instituted reservation policy for coal vessels calling at Curtis Bay. Under this policy, coal vessels register at the port to reserve a future loading time. The vessels can then leave the port and return about ten days prior to their reservation date. The use of a ten-day average wait here assumes that the the exporting facilities are operating near capacity.[2]

[2] Booz, Allen and Hamilton, Inc. The Economic Impacts of the Export of Coal Through the Port of Baltimore. 1981. Greater Baltimore Committee.

Besides these generalized assumptions on the way future coal shipments will be handled, assumptions specific to each employment category must also be made in order to calculate the direct employment for each affected sector. These assumptions, or estimating techniques, are based on factors which most affect the amount of direct employment in each category, i.e. total coal volume, number of ships, or total number of vessel days in port. The following employment-estimating methodologies are used for the different employment categories[3]:

1. Railroad workers - are seen as depending on total coal volume. It has been estimated by BAH that for every 1.0 percent increase in coal tonnage, the amount of railroad workers will increase by .51 percent.

2. Chandlers and Launch Service Workers - are seen as being most dependent on the number of vessel days in port. Increases in these jobs are thus calculated by the following ratio,

$$\frac{\text{1980 Chandler and Launch Service Employment}}{\text{1980 Vessel days in port}} \quad X \quad \text{Future vessel days in port}$$

3. Shipyards, Testers, Towing, Pilots, Agents and Government Workers - are seen as being most influenced by the total number of vessels. Therefore, increases in these employment categories are calculated using the following ratio,

$$\frac{\text{1980 Employment in these categories}}{\text{Number of 1980 ships}} \quad X \quad \text{Future number of ships}$$

4. Local Service Workers - are dependent on both the number of ships and the total vessel days in port. Increases for these workers are, therefore, calculated by the following ratio,

$$\frac{\text{Future number of ships}}{\text{Number of 1980 ships}} \quad X \quad .54$$

   This ratio takes into account the change in vessel days from thirty in 1980 to ten in the foreseeable future.

5. Coal terminal Employees - The number of Chessie coal pier employees are assumed to remain constant. The other coal terminals are assumed to employ about 100 workers each.

[3] Booz, Allen and Hamilton, Inc.

6. Banks and Insurance Employees - A modest increase of six employees over 1980 totals is estimated for the foreseeable future.

Direct employment totals are projected to increase by 1,443 jobs over 1980 totals, an increase of 94 percent by year 2000 under the "most likely" coal export projection (see Table 3.6). If the "high" scenario projection were to become reality, it is estimated that direct employment would increase by 2,239 jobs over 1980 totals, or 146 percent. The majority of these total increases are made up of additional railroad and coal terminal workers. For example, for the "most likely" projection in year 2000, 70 percent of the increase is made up of additional railroad workers and 19 percent are additional coal terminal employees. For the "high" scenario projection, the percentage of the total increase are 67 and 17 percent, respectively, for these two employment categories. It is interesting to note that direct local service employment actually drops from 1980 to 1985 and is only slightly larger in 1990. This is due to the lower number of total vessel days in port in 1985 and 1990 (a drop which is not totally compensated for by an increase in the number of vessel calls).

Using the BRIO Model to Estimate Total Economic Impacts

The procedure for translating direct employment impacts into final demand for use in the BRIO model is the same as that used previously. Tables C-1 through C-5 (Appendix C) illustrate the conversion of direct employment data to final demand for use in the BRIO model. Tables C-6 through C-10 condense the information in each of these tables and present the final demand figures in the form in which they are entered into the model. Once again, the railroads and water transportation (BRIO) sectors receive the bulk of the final demand.

Projected Total Impacts

The results of the BRIO runs for each of the coal export projections are presented in Table 3.7 As mentioned previously in the discussion of the 1980 coal exports, the model reveals that there are substantial additional output and employment impacts which can be associated with the export of coal through the Port of Baltimore. For example, by year 2000, under the "most likely" tonnage projections, $306 million worth of additional regional output and over

TABLE 3.6

DIRECT EMPLOYMENT IMPACTS IN THE BALTIMORE SMSA
FROM PROJECTED COAL EXPORTS THROUGH THE PORT OF BALTIMORE

Employment Category	1985(1) Jobs	1990(2) Jobs	1995(3) Jobs	2000(4) Jobs	2000(5 & 6) Jobs
Railroad Workers	1,260	1,575	1,697	1,980	2,474
Shipyards	79	96	108	132	176
Coal Terminal	177	377	377	377	477
Coal Testers	32	39	43	53	70
Towing	30	37	41	50	67
Pilots	11	14	15	18	25
Agents	35	42	47	58	77
Chandlers, Surveyors and Bunkering Firms	8	10	11	14	19
Local Service	129	158	176	217	289
Launch Crews	7	9	10	12	16
Government	30	37	41	50	67
Banks and Insurance	15	15	17	20	20
TOTAL	1,813	2,409	2,583	2,981	3,777

(1) 19.6 million tons of coal, 364 vessels, 3,640 vessel days.

(2) 27.5 million tons of coal, 446 vessels, 4,460 vessel days.

(3) 30.6 million tons of coal, 497 vessels, 4,970 vessel days.

(4) 37.7 million tons of coal, 612 vessels, 6,120 vessel days.

(5) 50.1 million tons of coal, 813 vessels, 8,130 vessel days.

(6) Represents the "high" scenario projection.

3,200 additional jobs are expected to be generated from coal exports. Altogether then, total regional output of $454 million and total regional employment of just over 6,200 jobs can be associated with the exportation of some thirty-eight million tons of coal through the Port of Baltimore. These figures represent a gain of $223 million (a 96 percent increase) in output, and an increase of 4,730 jobs (a 98 percent gain) over comparable 1980 figures. If fifty million tons of coal were to be exported through the port by year 2000 (under the "high" scenario), total regional output would rise to $582 million (an increase of 152 percent) and total employment would amount to just over 7,920 jobs (a 148 percent increase).

As with 1980 figures, the biggest additional gains in output (i.e. the indirect and induced effects) are in "Personal, Business and Other Services", "Retail Trade", "State and Local Government" and "Construction" sectors. For employment, the largest additional gains are in "Retail Trade", "Personal, Business and Other Services", "State and Local Government"and "Wholesale Trade" sectors. (See Appendix D for a breakdown of overall increases in output and employment.)

Illustrating the additional employment gains, with thirty-eight million tons of coal exports, over 930 jobs in retail trade and over 740 jobs in services, not directly linked to the coal exports, would be generated. Total employment (including those jobs which are directly related to the coal exports) would be largest in the "Transportation, Communication and Utilities" sectors (2,744, mostly because of the large number of railroad workers) and in the "Services" sector (just over 1,000).

Fiscal Impacts

Besides increased employment and output, the movement of coal through the Port of Baltimore also generates tax revenues to the state and local jurisdictions. These revenues include state sales taxes, state and local personal income taxes and corporate income, property and personal property taxes.

In order to estimate state an local personal income taxes that are associated with coal exports, estimates must first be made on the total amount of income generated. Additionally, it would be advantageous to be able to allocate these income and tax impacts by jurisdiction.

TABLE 3.7

COAL IMPACT TEST, 1985-2000 PROJECTED COAL EXPORTS

	1985	1990	1995	2000	2000[2]
I. Indirect and Induced Impacts					
Regional Production[1]	179.89	250.87	268.12	306.47	392.53
Employment (Jobs)	1,890	2,650	2,840	3,230	4,140
II. Total (Direct, Indirect and Induced) Impacts					
Regional Production[1]	264.32	373.88	398.81	453.97	581.86
Employment (Jobs)	3,700	5,060	5,420	6,210	7,920
III. Multipliers					
Regional Production	3.1	3.0	3.0	3.1	3.1
Regional Employment	2.0	2.1	2.1	2.1	2.1

[1] Millions of 1983 dollars

[2] "High" Scenario

Income Estimates

Estimates of total income generated from various coal export volumes can be obtained from the BRIO model output as shown in Tables 3.4 and 3.5 for 1980, and Tables D.1 through D.5 (see Appendix D) for the years 1985 through 2000. In these tables, the row labeled "Wage and Salary/Consumer Exp." indicates the income generated by the employment associated with the particular tonnage of coal exports. One method for allocating these total income figures to the jurisdictions is to apportion them in the same manner as the direct employment associated with the 1980 coal exports. The direct employment by worker residence, (as estimated by a BAH survey for both 1980 scenarios) is listed in Table 3.8 Nearly half of the workers directly associated with the coal exports traffic of 1980 resided in Baltimore City, while nearly a third lived in Baltimore County. Using the 1980 four-day scenario distribution (because of its more likely representation of steady state conditions), Table 3.9 presents the distribution across jurisdictions for the total employment associated with the movement of coal through the Port of Baltimore for the years 1980 through 2000.

In using this particular methodology, it is assumed that the expenditures made by those firms and workers directly associated with the movement of coal will be such that the additional employment generated will be filled, for the most part, by workers who reside, proportionately, in the same jurisdictions as the 1980 direct employment. Furthermore, it is assumed that this allocation will remain valid in the future.

While these assumptions may not be entirely accurate, they do have a great deal of plausibility behind them in that most of the activity associated with coal exports is concentrated in Baltimore City, Baltimore County and Anne Arundel County. The assumptions being used here thus represent a logical extension of current data that should yield probable employment trends.

Extending the employment distribution to labor income generated from the different coal export projections, it can be seen that the wage and salary income associated with total employment will go from \$69 million in 1980 to \$139 million in year 2000, a 101 percent increase, or to \$178 million in year 2000 under the high tonnage scenario, a 158 percent increase (see Table 3.10). Almost 93 percent of the income totals are generated from employees residing in Baltimore City, Baltimore County and Anne Arundel County.

TABLE 3.8

1980 DIRECT EMPLOYMENT IMPACT BY RESIDENCE

JURISDICTION	THIRTY-DAY SCENARIO EMPLOYMENT	PCT	FOUR-DAY SCENARIO EMPLOYMENT	PCT
Baltimore City	743	48.3	671	47.6
Anne Arundel Co.	206	13.4	192	13.6
Baltimore County	486	31.6	445	31.5
Carroll County	26	1.7	26	1.8
Harford County	38	2.5	38	2.7
Howard County	39	2.5	39	2.8
TOTALS	1,538	100.0	1,411	100.0

Source: Booz, Allen and Hamilton, Inc.

TABLE 3.9

TOTAL EMPLOYMENT IMPACTS BY RESIDENCE, 1980-2000

JURISDICTION	1980[1]	1985	1990	1995	2000	2000[2]
Baltimore City	1367	1760	2406	2577	2953	3766
Anne Arundel Co.	390	503	689	738	845	1078
Baltimore Co.	904	1167	1596	1709	1959	2498
Carroll Co.	52	68	93	100	114	146
Harford Co.	78	100	136	146	167	213
Howard Co.	80	102	140	150	172	219
TOTALS	2871	3700	5060	5420	6210	7920

1 Four-Day Scenario

2 "High" Scenario

TABLE 3.10

TOTAL INCOME IMPACT BY JURISDICTION, 1980-2000
(millions of 1983 dollars)

Jurisdiction	1980[1]	1980[2]	1985	1990	1995	2000	2000[3]
Baltimore City	33.48	29.99	39.39	53.36	57.33	66.01	84.43
Anne Arundel Co.	9.27	8.55	11.20	15.30	16.38	18.91	24.21
Baltimore Co.	21.80	19.87	26.14	35.41	38.06	43.84	56.01
Carroll Co.	1.20	1.20	1.56	2.05	2.17	2.53	3.25
Harford Co.	1.69	1.69	2.17	3.01	3.25	3.73	4.94
Howard Co.	1.69	1.69	2.29	3.13	3.37	3.85	4.94
TOTALS	69.13	62.99	82.75	112.26	120.56	138.87	177.78

1 Thirty-Day Scenario

2 Four-Day Scenario

3 "High" Scenario

State and Local Personal Income Taxes

From 1979 and 1980 summary tax return data for Maryland residents, BAH determined that only 71 percent of Maryland reported gross income was taxable under Maryland local and state personal income tax laws. Of this taxable income, approximately 6.8 percent (or just under 5 percent of total income) is paid in state and local income taxes. Slightly more than a third of these taxes is distributed to local jurisdictions while the remainder goes to the state. The state and local personal income tax figures were calculated based on total income (see Table 3.11). The total personal income taxes collected increase from $3.3 million in 1980 to $6.7 million in year 2000, or to $8.6 million in year 2000 under the high tonnage scenario. Estimates of the local tax distribution by jurisdiction based on total income generated are given in Table 3.12.

Sales Taxes

State sales tax figures can also be estimated from the BRIO model's total income numbers. BAH found that Maryland residents spend approximately 50 percent of their income on goods and services produced in the State of Maryland; the rest is either saved, taxed, or used for purchases outside of the state. Furthermore, they estimated that 33 percent of these expenditures are for goods and services subject to the Maryland sales tax laws. Applying the state sales tax rate of 5 percent to 33 percent of half of the total income figures from the BRIO model output yields the sales tax collections shown in Table 3.13. These figures range from an estimated $570,000 collected in 1980 (in 1983 dollars) to a projected $1.5 million in year 2000 for the high tonnage scenario. Sales tax collections go into the state's general fund and are not specifically allocated to the local jurisdictions.

Corporate Taxes

The estimation of state corporate taxes generated by coal exports is extremely difficult without detailed knowledge of the specific firms involved. The lack of what is essentially confidential information is compounded by the fact that railroads, an integral part of the movement of coal, are considered utilities for tax purposes and are taxed on a unit assessment basis (track in Maryland to track outside of Maryland, property in

TABLE 3.11
STATE AND LOCAL PERSONAL INCOME TAXES
(millions of 1983 dollars)

	1980[1]	1980[2]	1985	1990	1995	2000	2000[3]
State	2.20	2.00	2.65	3.60	3.87	4.44	5.70
Local	1.13	1.04	1.35	1.82	1.95	2.25	2.88
TOTAL	3.33	3.04	4.00	5.42	5.82	6.69	8.58

1 Thirty-Day Scenario
2 Four-Day Scenario
3 "High" Scenario

TABLE 3.12
LOCAL PERSONAL INCOME TAX DISTRIBUTION
(millions of 1983 dollars)

JURISDICTION	1980[1]	1980[2]	1985	1990	1995	2000	2000[3]
Baltimore City	.54	.49	.64	.86	.93	1.06	1.36
Anne Arundel Co.	.16	.14	.19	.25	.28	.31	.40
Baltimore Co.	.36	.32	.42	.57	.60	.70	.90
Carroll Co.	.02	.02	.02	.05	.05	.06	.07
Harford Co.	.02	.02	.04	.05	.05	.06	.07
Howard Co.	.02	.02	.04	.05	.05	.06	.07
TOTALS	1.12	1.01	1.35	1.83	1.96	2.25	2.87

1 Thirty-Day Scenario
2 Four-Day Scenario
3 "High" Scenario

TABLE 3.13
STATE SALES TAX COLLECTIONS
(millions of 1983 dollars)

	1980[1]	1980[2]	1985	1990	1995	2000	2000[3]
	.57	.52	.68	.93	.99	1.14	1.47

1 Thirty-Day Scenario
2 Four-Day Scenario
3 "High" Scenario

Maryland to property outside of Maryland, etc.). Any pier or storage facilities operated in conjunction with the railroad would be assessed as part of the railroad operating unit.

There are of course a variety of corporate taxes, including:

> Gross Receipts Tax - The B & O Railroad, part of the Chessie System, pays a tax of 0.5 percent of gross receipts in lieu of other taxes it is exempted from in Baltimore City. The gross receipts are calculated from rail operations, interest, dividends, rents and royalties.
>
> Corporate Income Tax - All corporations doing business in the State of Maryland are required to pay a tax on corporate net income. This tax is levied at a rate of 7 percent and in-state corporations would pay a straight 7 percent on their federal taxable income. However, out-of-state corporations pay a percent share of their federal taxable income based on the corporations' amount of property, payroll and sales (in which goods are shipped to Maryland as a final destination) occurring in the State.
>
> Personal Property Tax - Personal property and equipment are taxed at a rate of $.20/$100.00 by the state, and $5.93/$100.00 by the City on the assessed value of such property. Personal property is assessed at its historical rate at the time of construction. This assessed value is depreciated at 10 percent annually until it reaches 25 percent of its original value, at which level the assessment is frozen. According to state and city law, manufacturing equipment and inventory are both exempt from personal property taxes. It is not clear whether coal loading equipment is covered under this exemption.

There is no completely satisfactory method for estimating state corporate income taxes because of the lack of available detailed knowledge on individual firms, and the fact that corporate income tax payments are confidential. Nevertheless, useful ballpark estimates can be obtained from the information at hand. For example, Table 3.14 lists the total federal income taxes generated by firms in the Baltimore Region for the two scenarios for 1980, and for projected coal volumes as calculated by the Baltimore Regional Input-Output Model. It should be pointed out that these taxes are the result of direct, indirect and induced expenditures initiated by the coal traffic.

In order to go from federal corporate income tax figures to state corporate income tax estimates, it was found that in 1980 approximately 35 percent of corporate net income was paid in federal income taxes.[4] Therefore,

[4] John Voith, Internal Revenue Service, Returns Analysis Section, Corporation Branch.

TABLE 3.14

FEDERAL AND MARYLAND CORPORATE INCOME TAX REVENUES
GENERATED BY COAL EXPORT ACTIVITY
(Millions of 1983 Dollars)

YEAR	FEDERAL[1]	MARYLAND[2]
1980*	4.38	.877
1980**	3.93	.785
1985	5.14	1.029
1990	7.13	1.426
1995	7.65	1.530
2000	8.73	1.746
2000***	11.18	2.240

* Thirty-Day Scenario

** Four-Day Scenario

*** "High" Scenario

1 From the Baltimore Regional Input Output Model

2 Maryland Corporate income tax is calculated as being 20 percent of the federal corporate income tax paid.

it can be assumed that Maryland corporate income taxes amounted to approximately 20 percent of paid federal taxes (the 7 percent state rate divided by the 35 percent of corporate income paid in federal taxes) (see Table 3.14). In 1980 approximately $877,000 in state corporate income taxes were paid by regional firms affected by coal related activity, $92,000 more than would have been the case under the four-day scenario. By year 2000, $1.75 million is projected to be paid by regional firms, $2.24 million under the high tonnage scenario. These projected corporate income tax numbers assume that the 1980 relationship between state and federal corporate income taxes will remain constant in the future.

Calculation of personal property and real property taxes paid by firms associated either directly or indirectly with coal exports is also difficult since, for the most part, these participants are engaged in other commercial activity not related to the movement of coal. To allocate a portion of total personal and real property taxes to coal related activity would be a completely judgmental exercise, particularly for those firms only indirectly affected by coal traffic. Hence, it was decided that for 1980, personal and real property taxes would only be calculated for the Chessie coal pier, a facility which is totally dedicated to the movement of coal.

By researching public tax records, it was determined that personal and real property taxes in 1980 amounted to approximately $750 to the State and $83,000 to Baltimore City.[5] It is again stressed that this is the most conservative of measures for these taxes, but one which can be fully allocated to coal exports.

For future coal volumes, using the same methodology, personal and real property taxes were only calculated for the Chessie coal pier in Curtis Bay, the Curtis Bay Company (Island Creek) coal pier located adjacent to Chessie's facility and the Consolidation coal pier located in the Canton section of port, (these last two piers have recently become operational). Based on the most current tax records available, it was estimated that these three coal terminals would pay $19,300 to the State of Maryland and $668,500 to Baltimore

[5]Calculated by averaging fiscal year 1979 and 1980 personal property tax records and estimating from fiscal year 1982 real property tax records for the B&O Railroad property in Curtis Bay.

City in annual personal and real property taxes.[6] In additon, if the Marley Neck Coal Terminal were to be built in Anne Arundel County, under a high tonnage scenario, an additional $11,000 would be paid to the state and $1.4 million to Anne Arundel County annually in personal and real property taxes.[7]

[6]Calculated from fiscal year 1982 personal property taxes paid by the B&O Railroad in Curtis Bay, and Consolidation Coal Sales Co. in Canton and estimated personal property taxes from the Curtis Bay Company. Property taxes are calculated from fiscal year 1982 real property tax records for all three terminals. All figures are in 1983 dollars.

[7]Based on a 1981 fact sheet on the Marley Neck Coal Terminal prepared by the Anne Arundel County Department of Planning and Zoning. Numbers are in 1983 dollars.

CHAPTER IV

ENVIRONMENTAL AND COMMUNITY IMPACTS

The increased movement of coal through the region will have environmental impact at several levels. Air quality impacts will be felt throughout the region by increasing the total suspended particulates. Water quality will also feel the effects of the dust as it is deposited on land and carried into the waters by wind, rain, and snow. Regional water quality impacts will be harder to assess due to the limited knowledge about how the particulates would be distributed through the region.

More specific impacts on air quality, water quality, noise levels, and access will be felt throughout the rail corridors (generally defined as one-eighth mile on each side of the tracks along which the coal is moved) and at specific locations within or near the rail corridor.

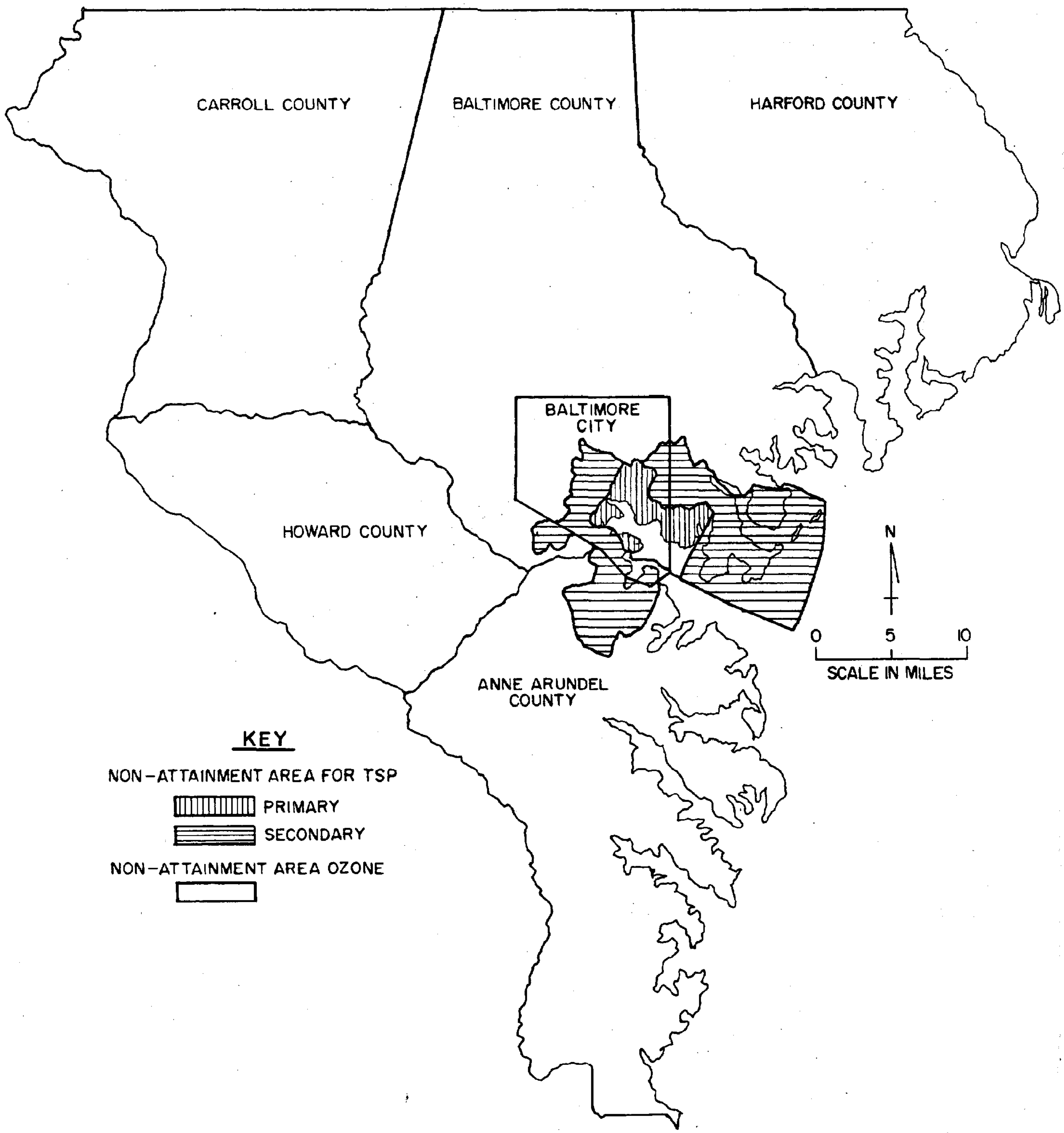
In general, environmental impacts are hard to quantify without detailed, intensive investigations. This chapter will use quantitative measures where possible, and otherwise identify the potential order of magnitude of environmental impacts.

AIR QUALITY

The air quality in the Baltimore Region is generally fair. Ozone, carbon monoxide and acid deposition pose continuing problems as population increases. Portions of Baltimore City, Anne Arundel and Baltimore counties which surround the tidal portions of the Patapsco River are in violation of primary and secondary standards for total suspended particulates (TSP), i.e., suspended dust (Figure 4.1).

The State Implementation Plan (SIP) has strategies to deal with all of these problems, and the RPC has developed an emissions trading program specifically for hydrocarbons (the precursors of ozone) and for particulates (TSP) within the non-attainment areas. Although some hydrocarbons will be emitted by train engines and equipment at coal terminals, the greatest potential for impact on the region is from coal dust emissions from rail movement. The remainder of this discussion will focus on the impact of coal dust on concentrations of total suspended particulates in the region.

FIGURE 4.1
METROPOLITAN BALTIMORE INTRASTATE AIR QUALITY CONTROL REGION



Particulate emissions, in general, do not have a significant impact at great distances from their source. Most settle out of the air fairly near their point of origin due to their weight. Distance traveled also depends on wind and weather conditions as well as the height of the source.

There are several sources of dust in coal export. Most of them are located at the export terminal or at the mine. The State Air Quality regulations require coal storage and handling operations to suppress dust. Binding chemicals and water sprays as well as physical enclosures and filters are used to accomplish desired levels. These requirements serve to keep emissions to a minimum at either end of the coal export process. No such regulations control the emission of coal dust during transport, however.

The emissions from rail cars carrying coal vary depending on the presence of rain or snow, train speed and the amount of fine-grained material[1]. In wind-tunnel tests of steam coal (with the same general characteristics as the coal transported through Baltimore) under average moisture conditions, between 0.5% and 2% of the total weight of the coal was lost. Train travel was simulated at 44 miles per hour for five hours, and the most severe loss in the first few hours of travel. However, dust continued to be emitted beyond that time. Although speed affects the rate of loss (see Figure 4.2), even very low speeds result in continuing emmissions of coal dust.

Even assuming that 90% of the expected loss occurs between the mine and the Carroll County border (outside of the region), between 18,850 and 25,050 tons per year (depending on the amount shipped) of coal dust could be spread along the rail corridors of the region in the year 2000 (see Table 4.1). This is roughly 250 pounds per day per mile of railroad carrying coal for <u>each</u> loaded train. (See Appendix E for methodology.) The 1980 Emmissions Inventory uses a figure of 422 tons of fugitive dust emitted annually by railroad sources, however, this does not include coal dust (which could have amounted to about 6200 tons annually using the same method employed above, see Table 4.2). Substituting this higher background figure, there could be an

[1]Nimerick, K.H and Laflin, G.P "Intransit Wind Erosion Losses of Coal and Method of Control". Presented at the 1977 Society of Mining Engineers Fall Meeting and Exhibit, St. Louis, Missouri - October 19-21, 1977. (Preprint Number 77-F-377.)

FIGURE 4.2
EFFECT OF WIND VELOCITY ON COAL LOSS FROM 1-1/2" X 0 STEAM COAL (NIMERICK, 1977)

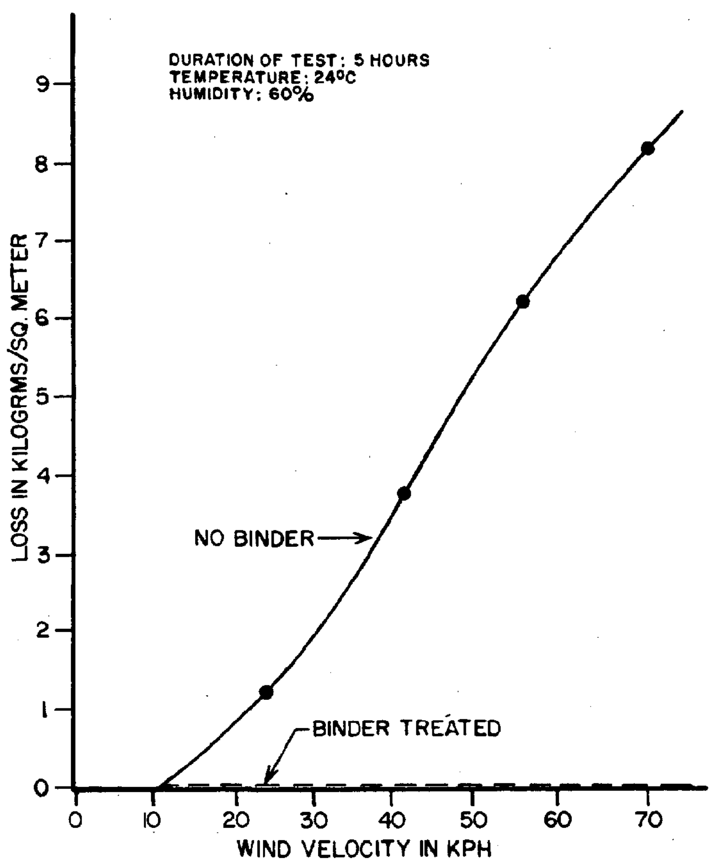


TABLE 4.1

COAL DUST EMISSIONS FROM TRAINS[1]
(Tons/Year)

	1985	1990	1995	2000
"Most Likely" Scenario	9,800	13,750	15,300	18,850
"High" Scenario	11,300	16,250	17,700	25,050

[1] Methodology shown in Appendix E.

TABLE 4.2

EMISSIONS INVENTORY FOR THE BALTIMORE REGION - 1980
SUSPENDED PARTICULATES

	Emissions Inventory		With Coal Dust Added[2]	
	Tons Per Year[1]	Percent	Tons Per Year	Percent
Registered Stationary Sources	32,600	37	32,600	35
Area Sources	7,702	9	13,480[2]	15
Motor Vehicles	46,741	54	46,741	50
Total	87,043	100	92,821	100

[1] Represents emissions in both attainment and non-attainment areas.

[2] Using emissions factors and methodology from Appendix E for dust from coal trains substituted for the 422 tons from rail sources used in the emissions inventory.

SOURCE: Table prepared by the RPC based on Maryland Air Management Administration data.

increase of 40% to 85% in the year 2000 over 1980 particulate area sources, assuming other sources of fugitive dust remain collectively about the same as 1980.

Nimerick[2] suggests that chemical binders now used to minimize fugitive dust on coal piles could reduce the emissions from rail cars to an acceptable level. He also suggests that losses of coal by wind erosion prevented by this would cover the cost of their use. We would assume that the rising cost of coal (since 1977) only further substantiates the financial incentives to apply chemical binders.

The effect of these emissions from coal trains in the next 20 years will be felt most strongly within one-quarter mile of the railroad tracks. Of the two rail corridors which will be carrying the coal traffic, more coal trains will make up a substantially larger proportion of total train movements on the Chessie System. Their tracks travel along the Patapsco River through the western portion of the region (see Figure 4.3). The approximately 1,700 homes which are located within this quarter-mile corridor as well as schools and hospitals in the area will experience a substantial increase in coal dust in the next 20 years which could affect people's health and property values. This increase could be as much as 1,870 pounds per day per mile, an approximately 44% increase in dust over current levels (1982).

The air quality impact on Patapsco State Park will be noticeable if chemical binders are not used. Although coal traffic will not be new to park visitors, the increased presence of coal dust would affect the quality of the recreational experience. Picnic benches and tables would have to be dusted off before use, and visitors would be exposed to higher particulate levels, increasing their relative risk of lung ailments.

WATER QUALITY

Water quality impacts are difficult to determine because air quality data are not precise. While it is safe to assume that most of the coal dust that comes from the Chessie line will fall within the watershed of the Patapsco River, it is impossible to tell how much of it will actually reach the

[2] Ibid.

FIGURE 4.3
RAIL CORRIDOR–SENSITIVE AREAS

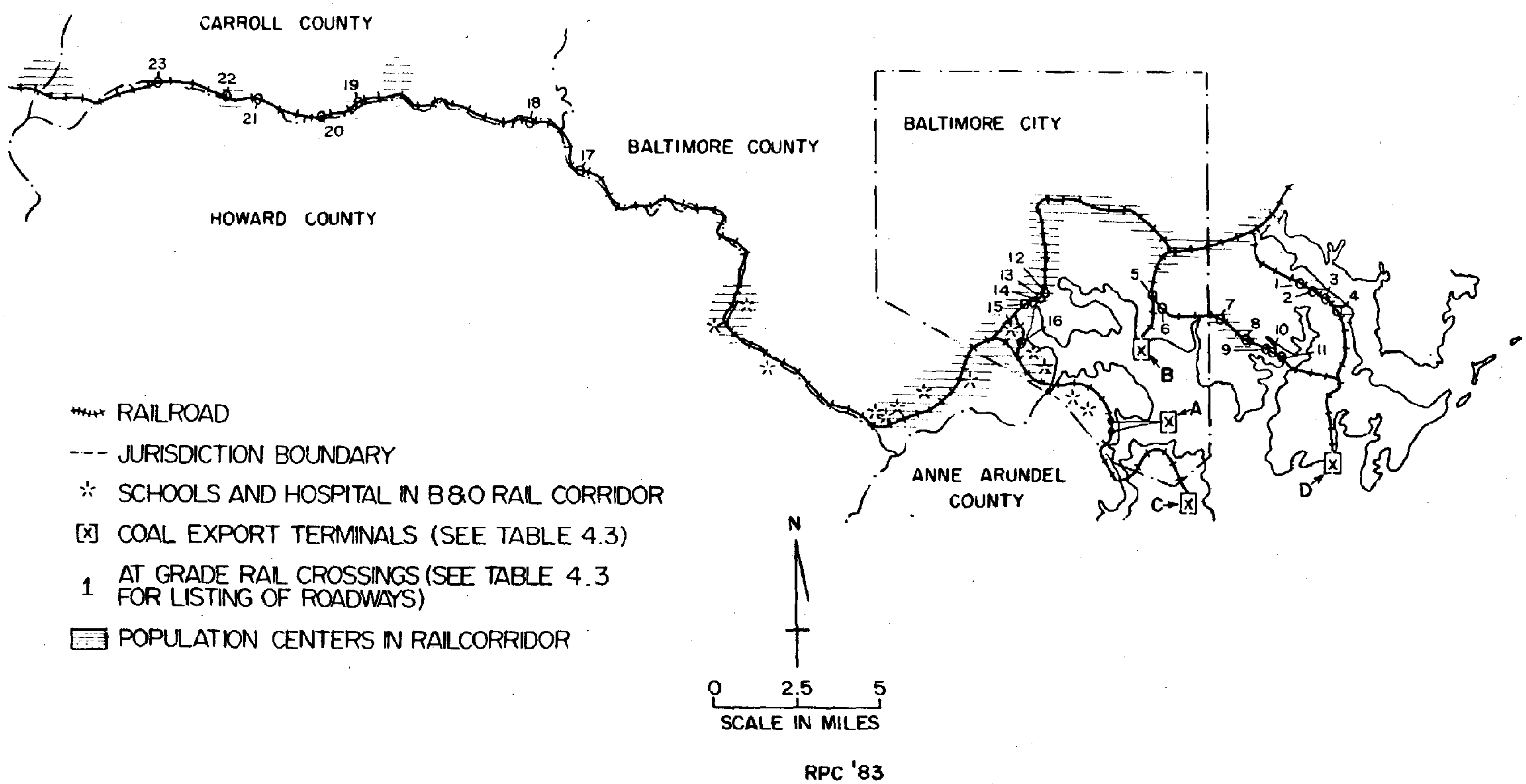


TABLE 4.3
NOTES FOR FIGURE 4.3

Coal Terminals

A - Curtis Bay and Island Creek
B - Consolidation Coal
C - Marley Neck (Proposed)
D - Sparrows Point (Proposed)

At-Grade Crossings

1. Trappe Road
2. Rose Bank Road
3. Beltzer Road
4. Beachwood Road
5. Boston Street
6. Ponca Street and Holabird Avenue
7. Maxwell Avenue
8. Willow Spring Road
9. Sollers Point Road and Merritt Boulevard
10. Chesterwood Road and Stansbury Road (West)
11. Stansbury Road (East)
12. Warner Street
13. Ridgely Street
14. Bayard Street
15. Bush Street
16. Waterview Avenue
17. Old Frederick Road (Johnnycake Road)
18. Marriottsville Road
19. Gaither Road
20. MD 97
21. Morgan Road
22. Salem Bottom Road (MD 94)
23. Watersville Road

water. However, the proximity of the railroad to the river guarantees that there will be an increased impact. Coal dust dropping into the water and running off the land would release sulphur and trace metals and would increase the acidity of the water. Because of the poor quality of the Patapsco's lower reaches, this impact could be significant. The reach of the river which parallels the tracks, is classified and intensively used for contact recreation. Fishing occurs all along the river, varying from put-and-take trout in the upper end (South Branch) to crabs and bluefish where it enters the Middle Branch[3]. Any degradation will affect the quality of the recreational experience in the Patapsco Valley Park.

The impacts are not expected to be as severe in the northeast corridor (Conrail line). Fewer tons of coal will be transported on this line and the line crosses the rivers instead of paralleling them, resulting in less impact to each river. Still, the cumulative effect is one that can result in continuing toxic pollution of Chesapeake Bay and its tributaries.

NOISE

As with other aspects of the environmental analysis, exact noise levels are hard to quantify. The difficulty arises because noise decays rapidly in both time and distance. Also the effects are not dramatic or necessarily immediate, but exposure disrupts lives and can reduce property values. Different people have different tolerance levels for noise, which they sometimes regard as "the price of progress."[4] Nevertheless, the physiological impacts of increased blood pressure, heart rate and breathing continue to occur even though people may think they have adapted to a high noise level. Long-term irreversible damage can result from exposure and the effects are cumulative. In general, high noise levels interfere with speech comprehension and reduce the attention span, as well as disturbing sleep and rest. All these effects increase the level of stress to which people are exposed.[5]

[3] Regional Planning Council. Water Quality Management Plan for the Baltimore Metropolitan Region. 1980, Baltimore.

[4] National Bureau of Standards. The Economic Impact of Noise. 1971, Washington, D.C.

[5] National Bureau of Standards. The Social Impact of Noise. 1971, Washington, D.C.

The significance of noise impact is partially related to the increase over background levels. An increase of nine decibels over the ambient levels will result in sporadic complaints from residents, and a 16 decibel increase will result in widespread complaints.[6] Because of high background levels due to heavy existing rail traffic in the Conrail corridor, significant impacts are expected only in the B & O corridor that runs along the Patapsco River.

In the B & O corridor, sensitive sites include schools and hospitals within 2000 feet of the tracks (see Figure 4.3). These facilities are the most seriously affected by high noise levels. Studies have shown that children in classrooms exposed to high environmental noise levels are at a significant disadvantage when compared to schools in quiet neighborhoods. This is due to disruption of concentration and interference with speech patterns. The generally poor physical condition of hospital patients makes them susceptible to the physiological impacts of noise, and recovery may be slower if sleep is disturbed.[7]

Residential uses are also very sensitive to noise, although at somewhat higher levels than sensitive school or hospital sites. Approximately 1700 residences are located in a 1/4 mile corridor, or primary noise impact area, along the B & O tracks (see Figure 4.3). With an average occupancy rate of 2.8, this means a minimum of 4,760 people could be affected by increased noise levels.

The impact of noise generated by ground transportation depends on its magnitude, the path it takes (and obstructions in that path) and the sensitivity of the receiver. In most cases, the Chessie rails run through a steep sided river valley which tends to trap and confine the sound within the valley. The rural nature of the area means that the residents are more sensitive to noise than urban dwellers. However, the railroad has always been a part of the environs and more trains may not be completely unwelcome.

Community reaction to noise has been documented through social surveys conducted world wide. There is a strong correlation among these findings (see

[6]Op cit. The Economic Impact of Noise.

[7]Op cit. The Social Impact of Noise.

Figure 4.4). This shows the close clustering of annoyance curves from many transportation sources. The study indicated that very few people (on average three to four percent) will be highly annoyed by noise at or below a level of about L_{dn} = 55 dB. However, about 16 percent of the population will be highly annoyed by noise at about a level of L_{dn} = 65 dB; twenty-five percent of the population will be highly annoyed at L_{dn} = 70 dB; and thirty-seven percent of the population will be highly annoyed as the noise level reaches L_{dn} = 75 dB. Twenty to thirty percent of the population are apparently imperturbable and not bothered even by high noise levels.[8] According to an EPA study on safe levels of exposure, approximately seventeen percent of the population will be highly annoyed at an L_{dn} of 55 dB, and over forty percent of the population will be highly annoyed if the L_{dn} exceeds 70 dB, the maximum safe level EPA has identified to protect against a risk of hearing loss. Complaints occur at a much lower rate than annoyance, and generally do not become evident until the noise levels are rather high. At an L_{dn} of 70 dB, approximately ten percent can be expected to complain, while twenty-five to forty percent of the population will be annoyed. At an L_{dn} of 55 dB, complaints are expected to be almost non-existent. Vigorous community action can be expected as the L_{dn} exceeds 70 dB (See Figure 4.5).[9]

The varying impact of varying levels of coal export is shown graphically on Figure 4.6 and Table 4.4. Within 100 feet of the tracks, noise levels are fairly high even under existing conditions (1982 coal export levels). The percent of people highly annoyed ranges from ten to thirty percent (480-1,450 people) with the "most likely" projections for the year 2000. The "high" scenario would cause between 20-45% (970-2,180 people) of the population within 400 feet of the track to be highly annoyed.

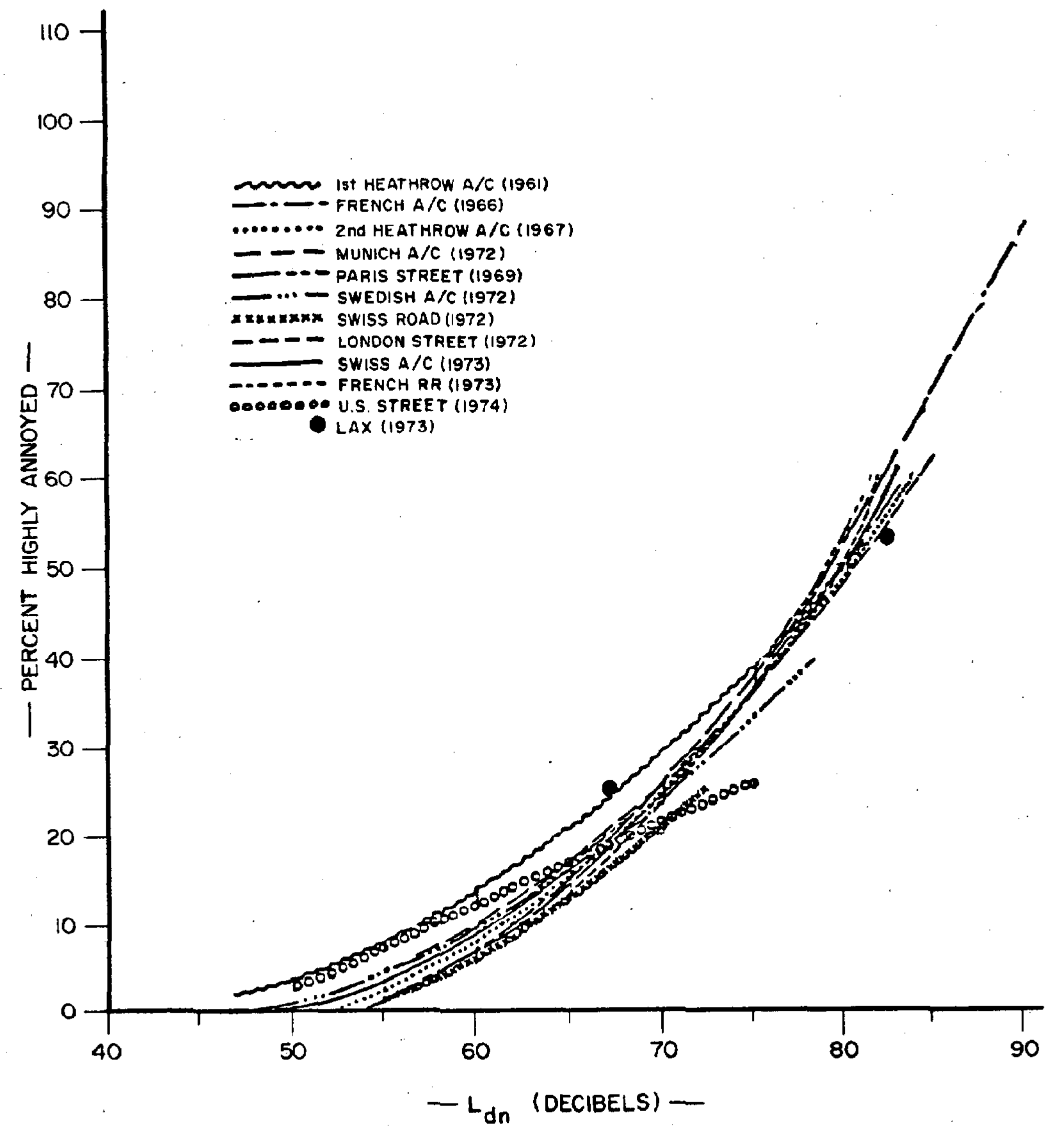
In studies prepared by the Environmental Protection Agency (EPA), widespread complaints and threats of legal action accompany adjusted day/night sound levels (L dn) of 60 or more.[10] Even 1982 levels of noise from trains

[8]U.S. Environmental Protection Agency. "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety". 550/9-74-004 (November 1978).

[9]*Op cit*. EPA.

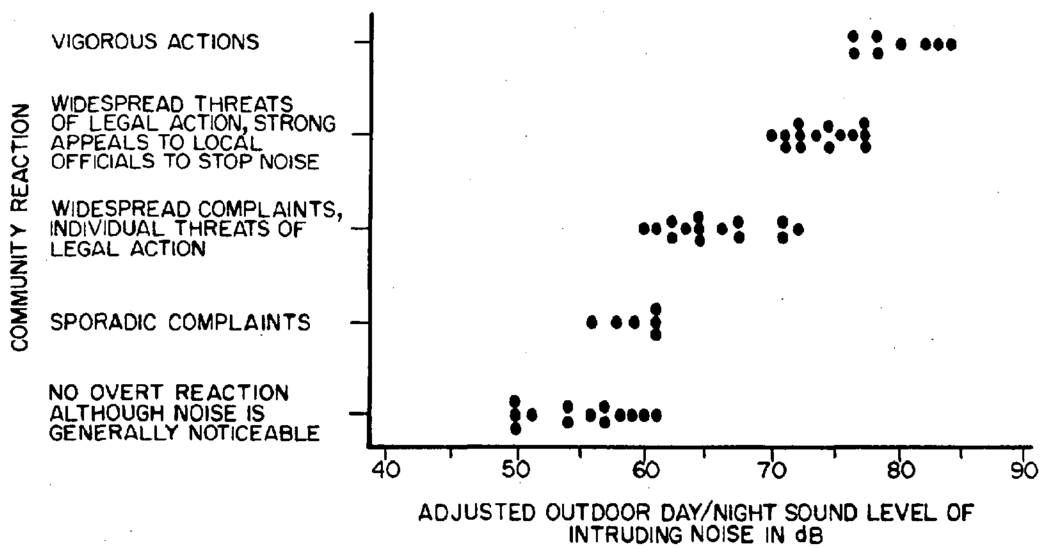
[10]U.S. EPA. *Noise Effects Handbook*. 1981. Washington, D.C.

FIGURE 4.4
SUMMARY OF ANNOYANCE DATA FROM 12 SURVEYS
WITH DATA SHOWING CLOSE AGREEMENT



SOURCE: U.S. ENVIRONMENTAL PROTECTION AGENCY

FIGURE 4.5
COMBINED DATA FROM COMMUNITY CASE STUDIES
ADJUSTED FOR CONDITIONS OF EXPOSURE



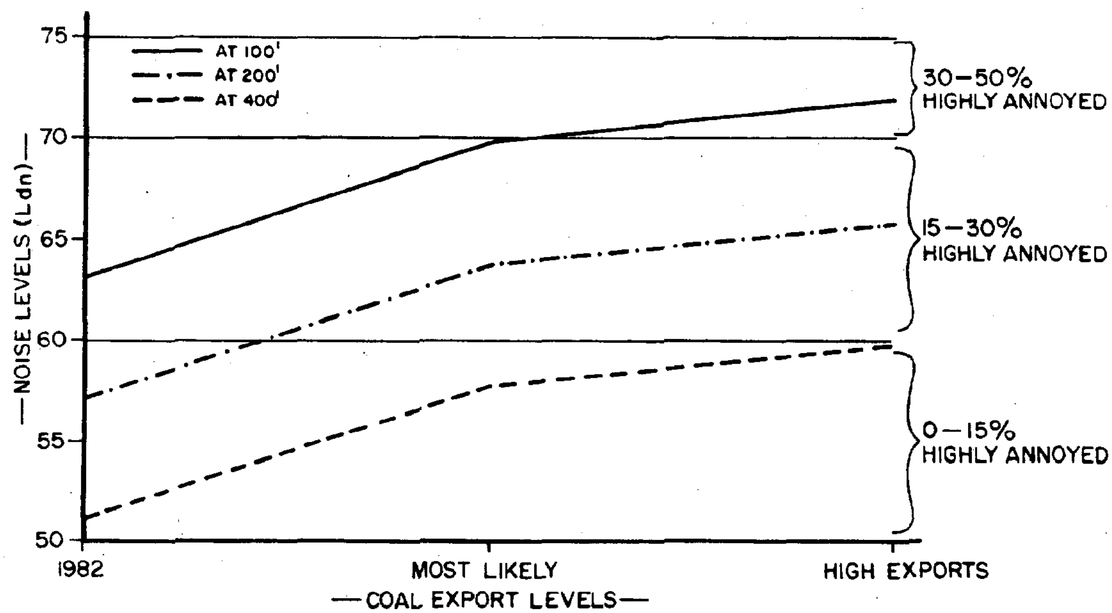
SOURCE: U.S. ENVIRONMENTAL PROTECTION AGENCY

TABLE 4.4

PROJECTED NOISE LEVELS (L_{dn}) - B & O RAILROAD CORRIDOR

	100 feet	200 feet	400 feet
Existing Levels (1982)	63.1	57.1	51.1
"Most Likely" Scenario	69.7	63.7	57.7
"High" Scenario	71.8	65.8	59.8

FIGURE 4.6
PROJECTED NOISE LEVELS
AND PERCENT OF PEOPLE ANNOYED
(B & O RAILROAD CORRIDOR)



SOURCE: REGIONAL PLANNING COUNCIL ESTIMATES serving the Curtis Bay Terminal only were above this level. Elevated levels will only aggravate the situation for those living within the primary noise impact area.

Based on these rough calculations, there is clearly a need to consider buffering areas of severe noise impact from the railroad. Site specific analysis is necessary to determine the best solution to each case.[11] The most sensitive sites (see Figure 4.3) based on this analysis, would certainly have to be protected if the "high" scenario materialized. As the Island Creek Terminal comes into full operation, sensitive sites should be monitored to determine the need for mitigation.

ACCESS AND PUBLIC SAFETY

The increase in coal trains will limit access in the region wherever there is an at-grade crossing. Total time when a train is blocking a road will be doubled or tripled in almost every case. Increased train traffic also increases the chances that an accident or mechanical failure will halt the train in the roadway for long periods of time. Where alternate routes are available, this would be an inconvenience to residents and businesses. However, it could be a serious problem for emergency vehicles. In the few cases where the train blocks the only access to a neighborhood, the prospect of a significant increase in the time this access is blocked and the possibility of a disabled train is considerably more serious. Depending on the amount of train and auto traffic as described in an RPC staff paper,[12] grade separation is recommended for major routes and emergency access/detour routes are recommended for those with less volume.

Public safety must also be considered when train traffic is increased. Inadequate signalling and signals which are not sensitive to the speed of the train (especially gates which close too far in advance of a train crossing or during switching operations which may never cross the street) encourage people to ignore the warning and attempt to "beat the train." In many areas,

[11] Note: For a detailed analysis of mitigation recommended by Baltimore City, see their companion report.

[12] Coal Movement in the Baltimore Region. Carl C. Dederer, Jr., March, 1982. Regional Planning Council staff paper.

inadequate sight distance makes this practice extremely hazardous, resulting in 26 serious accidents in 1981 - 1982.[13] New warning signs, speed sensitive signals (which are activated according to time rather than distance between the train and the road) and optional manual operation of signals during switching activities should be installed as soon as possible to prevent further accidents as train traffic (and in most cases, auto traffic) increases over time.

Detailed surveys were conducted for at-grade crossings in Baltimore City.[14] This report lists crossings, their physical condition, and specific recommendations for improvement. This level of detail was not possible for crossings outside of the city, so recommendations are based on information from local transportation planning offices. Based on both sources of information, the following locations will need improvement to accommodate increased rail traffic by the year 2000 (see Figure 4.7).

<u>B & O Mainline</u>

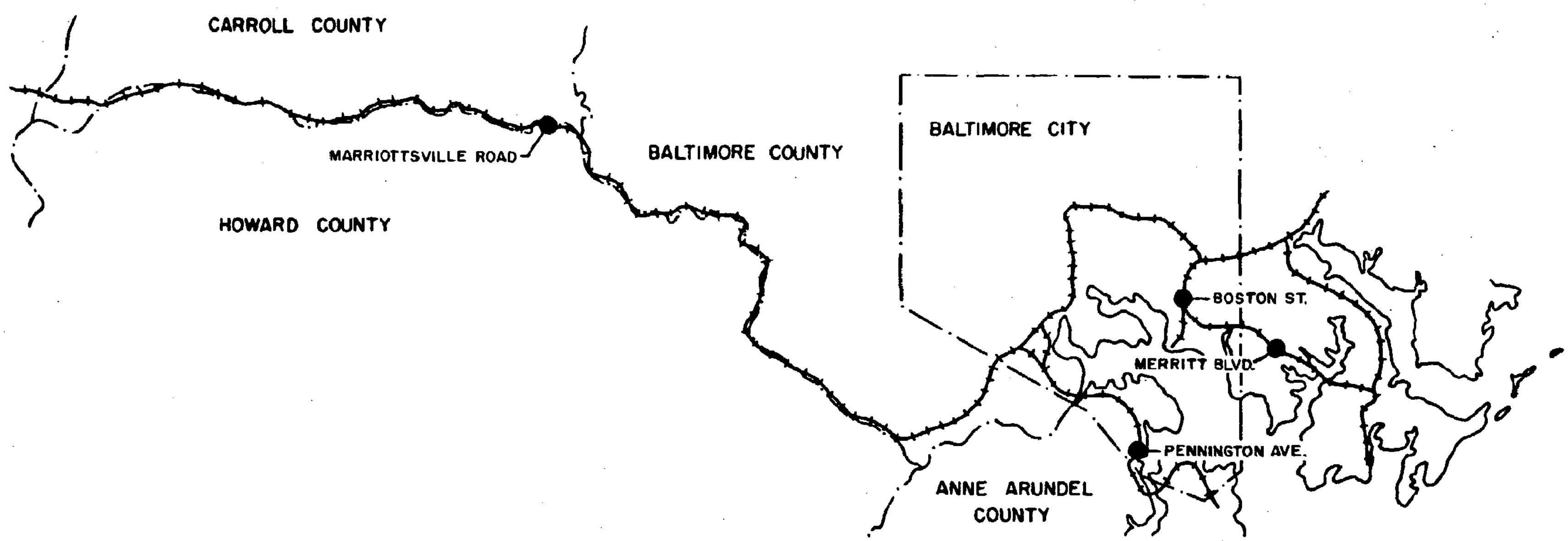
Increased coal movement in the western part of the region would primarily inconvenience automobile commuters. The adjoining sections of both Howard and Carroll counties are residential areas. Routes 94 and 97 cross the railroad at Woodbine and Hoods Mill, carrying Carroll County commuters directly south to Washington or to the Route 70 approach to Baltimore. Freight trains pass this area at 35 miles per hour, so that although the likelihood of being held up at a grade crossing would greatly increase with the number of coal trains, the length of a delay would not increase significantly. The traffic count, 3000 vehicles a day at Woodbine and 1500 at Hoods Mill, would not justify the cost of overpass construction.

The traffic count at Marriottsville Road is listed at 2300 vehicles a day and is expected to rise as population increases. This is used by commuters to Baltimore or Columbia from the southeast section of Carroll County, the county's fastest growing area. In addition, Howard County's master plan

[13] <u>Baltimore City Railroad/Highway Crossings Observation Report</u>. Baltimore City Department of Planning, 1983.

[14] <u>Ibid</u>.

FIGURE 4.7
LOCATION OF RECOMMENDED GRADE SEPARATIONS



recommends an office center at Turf Valley, four miles south on Marriottsville Road, which would increase the numbers of people commuting from Carroll County. This crossing has been given a relatively high hazard rating by the Maryland Department of Transportation, and there is a potential for longer delays because trains slow for curves in this area. The rail line was laid so close to the river that to build an overpass for vehicular traffic would also involve raising the nearby river bridge. At present, there are plans to replace the old bridge over the river at Marriottsville at grade level. Assuming the Turf Valley development increases traffic significantly on Marriottsville Road, increasing coal traffic will require grade separation in the next 20 years. If construction of the planned bridge replacement is delayed much longer, a grade separation should be considered instead.

Increased rail activity will complicate vehicular movement (6500 per day) at the crossing of Howard County's Old Frederick Road to Baltimore County's Johnnycake Road. Commuters from rapidly growing northeastern Howard County use this direct backroad route to the Social Security complex. However, Baltimore County wants to discourage through-traffic on Johnnycake Road, so in this case, increased coal activity may serve to preserve residential areas.

In Baltimore City, the most serious problems occur at Boston Street. Already this major truck route and principal arterial experiences severe congestion from train traffic. In addition, problems are caused by trucks and autos trying to detour around these trains by turning around on this narrow street. This crossing is scheduled for grade separation as part of the Interstate 83 project; however, during the construction period alternate route signs and advance warning of approaching trains would help to alleviate the situation. Installation of a double gate system to prevent illegal crossing by motorists is also desirable. The need for these illegal crossings would be minimized if a manual override could be provided to the switching locomotive engineer when the trains are maneuvering near the road (but not crossing it).

Conrail Mainline

Grade crossing delays will not be a consideration as larger shipments of coal move down Conrail's northeast corridor mainline. Because of the plan to run the passenger trains at speeds up to 120 mph, it has been necessary to schedule construction of grade separations or to close roads at all grade crossings.

Impact on the mainline corridor would result from additional freight trains adding to an already crowded situation. There are problems with Amtrak line operations because of timing problems between high speed Amtrak passenger service and slower moving Conrail freight activity. At present, Conrail trains may use the northeast corridor mainline only between 10 p.m. and 6 a.m.

Marley Neck Terminal ("High" Scenario)

If a coal terminal would be built in the Marley Neck/Hawkins Point area (only needed under the "high" scenario), a grade separation should be provided at Pennington Avenue. This is a major access route with a high volume of traffic and currently experiences difficulties even with existing train traffic. Baltimore City has recommended a series of physical and operational improvements even under existing conditions.

There are two grade crossings in Anne Arundel County which will be affected. Ordnance Road receives much of the traffic from Pennington Avenue moving from Fairfield and Curtis Bay to the Glen Burnie-Ritchie Highway area. With a traffic count of 1200 vehicles a day, activity on Ordnance Road would be significantly affected with the addition of eight train crossings a day. Loaded trains would have to move slowly for the curve approaching the Marley Creek rail bridge. Construction to correct the problem would be complicated because the road meets the railroad tracks almost right under the Beltway precluding any space for a separated crossing. The road would have to be realigned to accomodate bridge over the tracks.

The other Anne Arundel County location is Kenbo Road, which is the only entrance to a large industrial firm, the Kennecott Refining Corporation. The Kennecott property adjoins the proposed coal export terminal location, so it is hard to imagine that the mile-long coal trains would be moving at more than a crawl or perhaps stopping entirely, as they prepare to enter the terminal.

Chessie has stated that trains could be held at the north shore of Hawkins Point until they could be moved briskly into the terminal. Arrangements might also be made to insure that trains would not block the plant entrance at the time that most of the employees report to or leave work. There might also be a way to route emergency service through the terminal property from Fort Smallwood Road.

Sparrows Point Terminal ("High" Scenario)

The proposed Sparrows Point terminal would receive coal by both Conrail and Chessie rail lines in the unlikely event that it is ever built. The Chessie line moves right through the middle of Dundalk. Offended by the noise and air pollution of Dundalk Marine Terminal[15], Baltimore Gas and Electric Company's Riverside power plant and synthetic gas plant, and the Bethlehem Steel works, residents of Dundalk have already expressed their feelings about the noise and safety problems of the existing several train movements[16] a day. The addition of two or three 15 mph coal trains a day to this line would not be popular.

At the eastern section of Dundalk, the only access to a group of 29 homes along Lynch Cove is by a "C" configuration of Stansbury Road involving two grade crossings of the railroad. This community was totally blocked for nearly two hours in December, 1981 when a freight train derailed.[17] In addition to the inconvenience, a situation like this would prevent access by emergency vehicles should they be needed. However, in the Lynch Cove area, it would be difficult to solve the grade crossing problem even with unlimited funds. The houses are in such a small area and so close to the tracks that there does not seem to appear to be space for the approach to an overpass. Alternatively, it is speculative if there is space to run an emergency lane out between the residential side of the tracks and the cove. A road on this side would have to be put through a fenced and solidly built-up industrial property.

Problems at the grade crossings on the Conrail line along the Back River could close off the Browning Ferris' Norris landfill on the northern end and a small community of North Point to the south. Between these two areas, a third community has an overpass at Cove Road. For emergency purposes, a road should be extended from the North Point community to the Cove Road area. A similar

[15]Buffer walls have already been constructed in some of the residential areas.

[16]At present, the track is being used for only one round trip a day, a stone train. In better economic times, there have been three or four daily freight trains on the Sparrows Point line.

[17]Op. Cit. Coal Movement in the Baltimore Region.

road should probably be allowed to connect to the landfill area, but residents would very likely insist that it be severely limited to emergency vehicles.

Conclusion

Should completion of the Consol and Island Creek terminals be the extent of coal terminal development in the Port of Baltimore, there does not appear to be an immediate need for extensive investment to ameliorate grade crossing impacts of coal traffic in suburban jurisdictions (with the possible exception of Marriottsville Road). Motorists will undoubtedly be inconvenienced, but many of the existing freight trains travel at night, and the traffic counts do not now justify expenditures for bridges over the tracks. This situation should be monitored over time. Improvements inside the Baltimore City boundaries are considered more urgent due to traffic volumes and safety issues. Many of these could be undertaken by the railroad companies as needed safety features, not necessarily related to increased coal export.

CHAPTER V
COST/BENEFIT ANALYSIS

The preceding chapters discussed the benefits and costs to the region of coal being exported through the Port of Baltimore. In this section, those benefits and costs which are quantifiable will be compared and allocated to the state or local jurisdictions where possible. In order for meaningful comparisons to be made, the costs and benefits over time will be converted into "equivalent" costs and benefits occurring at a single point in time. The point in time usually chosen is the present, and the mechanism for conversion is the standard equation for the calculation of the net present value.[1]

ASSUMPTIONS

The benefits and costs of the previous sections will be discounted to 1983 (the present). Benefits for each particular coal export volume will be allocated on a yearly basis beginning in the year in which the particular volume is projected to start and extending over a five year period. Costs are allocated at logical intervals which are a function of the projected coal volumes. The analysis will cover the time period from 1985 to 2004, but it should be realized that the operation of these coal piers will continue beyond this end point.

BENEFITS

Table 5.1 lists the net present value of all of the benefits that were presented in Chapter Three. As can be seen from this table, the benefits are quite substantial, amounting to $1.92 billion through 2004, or $1.99 billion if the high tonnage scenario is used over the last five years of the projection period.

The above benefits can also be broken down into private sector and public (i.e., local or state government) sector benefits, as illustrated in

[1]The interest rate or "discount factor" used in all calculations of net present value in this report is 10 percent (see Economic Analysis Handbook (NAVFAC P-442), Department of the Navy, Naval Facilities Command, July, 1980, p. 18).

TABLE 5.1

TOTAL NET PRESENT VALUE OF BENEFITS

1985 - 2004

(millions of 1983 dollars)

I.	"Most Likely" Scenario		
		Labor and Private Sector	$1,852.541
		Local Jurisdictional Governments	19.059
		State Government	44.552
		TOTAL	$1,916.152
II.	"High" Scenario for 2000 - 2004		
		Labor and Private Sector	$1,926.983
		Local Jurisdictional Governments	20.850
		State Government	46.354
		TOTAL	$1,994.187

Table 5.2. The majority of the benefits (nearly 97 percent) go to the private sector, consisting of wages and salaries paid to labor and the additional output of all of the firms in the Baltimore Region which are either directly or indirectly (through the multiplier effect) affected by the coal exports. The smallest amount (about 1 percent) is allocated to the local jurisdictions through personal income (piggyback) taxes and corporate personal and property taxes. The state government receives a little over 2 percent of the total benefits generated via personal and corporate income taxes, sales taxes, and corporate personal and property taxes.

It should be emphasized that the benefits to the state government shown here are only those taxes which accrue from the Baltimore Region. In actuality, total benefits to the state government from coal exports will greatly exceed this amount through taxes generated by additional employment at mines and other railyards and through taxes levied on the mining of coal.

Both private and local public benefits can be allocated to the local jurisdictions as illustrated in Table 5.2 and 5.3. Based on the geographical distribution of the employment directly associated with the movement of coal, the majority of the private benefits (nearly 48 percent) accrue to Baltimore City whose net present value of the stream of benefits amounts to $882 million ($917 million under the "high" scenario). Nearly 63 percent of the total public benefits (or $11.9 million) also accrue to the City. Baltimore County ($587.8 million) and Anne Arundel County ($253.8 million) receive the bulk of the rest of the public and private benefits.

In order to put the total benefits from coal exports in perspective, it would be helpful to take a look at another sector of the regional economy and to gage its economic impact. For example, SIC 28, Chemicals, one of the larger sectors of the regional economy, had $1.2 billion worth of shipments in 1977.[2] Converting to 1983 dollars, and assuming this value remains constant from 1983 to 2004, (a very conservative assumption), the present value of this stream of shipments is approximately $14.8 billion. Using a multiplier of 3.0, the present value of the total impact for this sector comes to over $44

[2] 1977 Maryland Census of Manufacturers, U.S. Department of Commerce, Bureau of the Census.

TABLE 5.2

LOCAL JURISDICTION DISTRIBUTION OF PRIVATE SECTOR BENEFITS
(millions of 1983 dollars)

Baltimore City	$ 881.809	$ 917.244
Anne Arundel County	251.945	262.069
Baltimore County	583.550	607.000
Carroll County	33.345	34.686
Harford County	50.019	52.029
Howard County	51.871	53.955
TOTAL	$1,852.539*	$1,926.983**

TABLE 5.3

LOCAL JURISDICTION DISTRIBUTION OF PUBLIC SECTOR BENEFITS
(millions of 1983 dollars)

Baltimore City	$ 11.910	$13.084
Anne Arundel County	1.854	2.267
Baltimore County	4.293	4.464
Carroll County	.246	.255
Harford County	.368	.383
Howard County	.382	.396
TOTAL	$19.059*	$20.849**

* Represents net present value of benefits, 1985 - 2004

** Represents net present value of benefits, 1985 - 2004 with the "High" tonnage scenario for years 2000 - 2004.

billion. It should be pointed out that this figure does not include taxes which would be generated to the state and local jurisdictions.

The calculation of the economic impact in the Baltimore Region of the Chemical sector illustrates the fact that while the benefits to the region from coal exports ($1.9 billion) can be viewed as "significant", they are small when compared to a major sector of the regional economy.

COSTS

Under the "most likely" scenario, the total net present value of costs associated with the increased volumes of coal passing through the Port of Baltimore is $19.1 million, the majority of which is for two projects, the Boston Street grade separation in Baltimore City and the grade separation of Marriottsville Road along the Howard and Carroll County border (see Table 5.4). In order to arrive at these costs, it was assumed that the two grade separations will be constructed during a 1985 to 1986 time span; the installation of the speed sensitive signals and protective fencing will take place in 1985, and the relocation of recreational facilities and the implementation of noise and visual barriers will be completed in 1986.

Under the "high" scenario coal shipment projections for the year 2000, three additional roadway modifications and improvements are hypothesized as necessary due to the construction of a fourth coal terminal to be located in the Marley Neck portion of Anne Arundel County. Since these identified improvements are projected so far into the future (year 2000) their net present values are quite small, amounting to just $3.0 million.

The responsibility for the identifiable costs has been assigned on the basis of traditional funding mechanisms (see Table 5.5). For the Boston Street grade separation, the most expensive of the infrastructure improvements, federal monies transferred from now defunct interstate highway projects have been identified as the probable funding source. However even though the cost of the project will not directly be borne by Baltimore City, it does use available sources of funds which could be put to other transportation-related uses. In other words, there is an "opportunity cost" (of other projects foregone) involved in using federal funds in the construction of coal-related roadway improvements.

The cost for the other grade separation project involved under the "most likely" scenario would, because of its location, be divided between the federal government (80 percent) and the two involved jurisdictions --Howard County (10 percent) and Carroll County (10 percent). Here, again, non-local funds carry with them an opportunity cost in their use.

Under the "high" scenario case, the Pennington Avenue grade separation would, under present conditions, involve a majority of federal funding with a 15 to 25 percent local match. The same would be true for the Ordinance Road project.

Table 5.6 illustrates the comparison of the net present value of public benefits and costs. In sum, there is an overall surplus of benefits over costs. However, there is an unequal distribution of these public costs and benefits. For example, of the six jurisdictions, Baltimore City is the only one which shows an excess of costs over benefits (of approximately $2.3 million) under the "most likely" scenario. The major benefactors appear to be the state, Baltimore County and Anne Arundel County, in that order. Of the three, only the state has a significant amount of benefits over costs (approximately 40 million). The high scenario slightly changes the values of the benefits and costs, but not their overall distribution.

TABLE 5.4

TOTAL NET PRESENT VALUE OF COSTS 1985 -2004
(Millions of 1983 Dollars)

I.	"Most Likely" Scenario	
	Boston Street Grade Separation[1]	13.0
	Speed Sensitive Signals[2]	.7
	Grade Separation at Marriottsville Road[1]	4.9
	Relocation of Recreational Facilities[3]	.12
	Fencing[2]	.11
	Noise/Visual Barriers[3]	.28
		$19.11
II.	"High" Scenario for 200 - 2004[4] (in addition to the costs above)	
	Pennington Avenue Grade Separation	2.5
	Speed Sensitive Signals	.1
	Detour and Emergency Road Access at Ordinance Road	.4
		$3.0

[1] 1985 - 1986 Construction Date

[2] 1985 Implemention Date

[3] 1986 Implemention Date

[4] 2000 Construction Date

TABLE 5.5

POTENTIAL PUBLIC COSTS OF MITIGATION
(Millions of 1983 Dollars)

I.	"Most Likely" Scenario	
		Net Present Value
	Baltimore City	$14.21
	Anne Arundel County	-
	Baltimore County	-
	Carroll County	.245
	Harford County	-
	Howard County	.245
	State	$ 4.410
II.	"High" Scenario	
	Baltimore City	$16.81
	Anne Arundel County	.4
	Baltimore County	-
	Carroll County	.245
	Harford County	-
	Howard County	.245
	State	$ .410

TABLE 5.6

POTENTIAL PUBLIC BENEFITS AND COSTS OF MITIGATION
(Millions of 1980 Dollars)

I. "Most Likely" Scenario

	Net Present Value of Benefits	Net Present Value of Costs
Baltimore City	$11.916	$14.210
Anne Arundel County	1.854	-
Baltimore County	4.293	-
Carroll County	.246	.245
Harford County	.368	-
Howard County	.382	.245
State	44.552	4.410
Total	$63.611	$19.110

II. "High" Scenario

	Net Present Value of Benefits	Net Present Value of Costs
Baltimore City	$13.084	$16.81
Anne Arundel County	2.267	.4
Baltimore County	4.464	-
Carroll County	.255	.245
Harford County	.383	-
Howard	.396	.245
State	46.354	4.410
Total	$67.203	$22.110

APPENDIX A

Using the BRIO Model

APPENDIX A

USING THE BRIO MODEL

Regional output of goods and services, along with employment, will depend upon the quantities of goods and services required by the final demand sectors. In other words, in an input-output model, final demand, the ultimate market toward which local production is geared, is exogenous, (i.e., it is estimated outside of the model). Once final demand is estimated, the model is run to produce total regional demand, production and employment impacts. Thus, given the BAH estimates of employment which directly resulted from the coal export traffic, total regional production and employment impacts can be determined by first translating the BAH employment figures into additional final demand using output-to-employment ratios and then running the BRIO model.

Table A.1 illustrates the necessary steps taken to translate employment figures into final demand. Output-per-employee figures derived from the BRIO data base are multiplied by the BAH employment estimates to yield final demand increases. In order to ensure that the final demand figures used in the model run will be initially translated into the proper increases in direct employment; allowances have to be made for "leakages" as represented by the trade coefficients. That is, adjustment of the final demand figures (by dividing them by the trade coefficients) will ensure that the initial regional employment impacts as measured by BAH will in fact be totally represented in the region. Subsequent (indirect and induced) impacts are calculated with the use of trade coefficients, meaning that subsequent regional demand will not be entirely satisfied by regional production. Tables A.1 and A.2 show the adjusted final demand figures under the thirty-day and four-day loading scenarios, respectively.

Tables A.3 and A.4 give a more compact representation of employment and adjusted final demand as it will be represented in the BRIO sectoring scheme. Table A.3 represents the thirty-day scenario, Table A.4, the four-day scenario. Note that the railroads, water transportation and personal services sectors make up the majority of the overall initial impact. The difference in the adjusted final demand for the two scenarios is small, representing about five percent ($119.0 million versus $113.4 million).

TABLE A.1 CONVERSION OF EMPLOYMENT DATA TO FINAL DEMAND - 30-DAY SCENARIO

BRIO SIC Code	Employment Category	Employment	Output per Employee (1)	Final Demand (2) (Millions)	Trade Coefficient (3)	Adjusted Final Demand (2, 4) (Millions)
4011	Railroad Workers	977	$ 11,163	$ 10.906	.118390	$ 92.121
4400	Barge Operators	51	55,920	2.852	1.0	2.852
3731	Shipyards	50	92,978	4.649	1.0	4.649
4400	Coal Terminal	177	55,920	9.898	1.0	9.898
7301	Coal Testers	20	12,986	.260	.7	.371
4400	Towing	19	55,920	1.062	1.0	1.062
4400	Pilots	7	55,920	.391	1.0	.391
4400	Agents	22	55,920	1.230	1.0	.230
4400	Chandlers, Surveyors and Bunkering Firms	16	55,920	.895	1.0	.895
7200	Local Service	152	14,250	2.166	.58	3.734
4400	Launch Crews	14	55,920	.783	1.0	.783
9880	Government (5)	19		.253	1.0	.253
6020	Banks and Insurance	14	31,900	.447	.6	.745
	TOTAL	1,538		35.792		118.984

(1) From the BRIO model in 1972 dollars.

(2) In 1972 dollars.

(3) From the BRIO model, represents proportion of regional demand satisfied by regional production.

(4) Final Demand ÷ Trade Coefficient.

(5) Since the Federal Government sector is placed outside of the transactions matrix, the employment impact is proxied by wages paid to households (SIC 9880) in 1972 dollars.

TABLE A.2 CONVERSION OF EMPLOYMENT DATA TO FINAL DEMAND - FOUR-DAY SCENARIO

BRIO SIC Code	Employment Category	Employment	Output per Employee (1)	Final Demand (2) (Millions)	Trade Coefficient (3)	Adjusted Final Demand (2, 4) (Millions)
4011	Railroad Workers	977	$ 11,163	$ 10.906	.118390	$ 92.121
4400	Barge Operators	--	55,920	--	1.0	--
3731	Shipyards	50	92,978	4.649	1.0	4.649
4400	Coal Terminal	177	55,920	9.898	1.0	9.898
7301	Coal Testers	20	12,986	.260	.7	.371
4400	Towing	19	55,920	1.062	1.0	1.062
4400	Pilots	7	55,920	.391	1.0	.391
4400	Agents	22	55,920	1.230	1.0	1.230
4400	Chandlers, Surveyors and Bunkering Firms	2	55,920	.112	1.0	.112
7200	Local Service	102	14,250	1.454	.58	2.507
4400	Launch Crews	2	55,920	.112	1.0	.112
9880	Government (5)	19		.253	1.0	.253
6020	Banks and Insurance	14	31,900	.447	.6	.745
	TOTAL			30.774		113.452

(1) From the BRIO model in 1972 dollars.

(2) In 1972 dollars.

(3) From the BRIO model, represents proportion of regional demand satisfied by regional production.

(4) Final Demand ÷ Trade Coefficient.

(5) Since the Federal Government sector is placed outside of the transactions matrix, the employment impact is proxied by wages paid to households (SIC 9880) in 1972 dollars.

TABLE A.3 1980 COAL RELATED EMPLOYMENT AND FINAL DEMAND FOR THE BRIO MODEL - 30-DAY SCENARIO

BRIO SIC Code	Description	Employ-ment	Final Demand (Millions)	Adjusted Final Demand (1) (Millions)
4011	Railroads	977	$ 10.906	$ 92.121
4400	Water Transportation	268	17.111	17.111
3731	Ship Building	50	4.649	4.649
7301	Business Services	58	.260	.371
7200	Hotels; Personal Services	152	2.166	3.734
9880	Government (2)	19	.253	.253
6020	Commercial Banks	14	.447	.745
	TOTAL	1,538	$ 35.792	$118.984

(1) In 1972 dollars.

(2) Represents wages paid by the Government Sector to households.

TABLE A.4 1980 COAL RELATED EMPLOYMENT AND FINAL DEMAND FOR THE BRIO MODEL - FOUR-DAY SCENARIO

BRIO SIC Code	Description	Employ-ment	Final Demand (Millions)	Adjusted Final Demand (1) (Millions)
4011	Railroads	977	$ 10.906	$ 92.121
4400	Water Transportation	205	12.806	12.806
3731	Ship Building	50	4.649	4.649
7301	Business Services	44	.260	.371
7200	Hotels; Personal Services	102	1.454	2.507
9880	Government (2)	19	.253	.253
6020	Commercial Banks	14	.447	.745
	TOTAL	1,411	$ 30.774	$113.452

(1) In 1972 dollars.

(2) Represents wages paid by the Government Sector to households.

APPENDIX B

Indirect and Induced Employment Impacts

APPENDIX B

INDIRECT AND INDUCED EMPLOYMENT IMPACTS

I. THIRTY-DAY SCENARIO

Code	Sector Description	Employment Gain
1511	General Contractors	40
4811	Telephone Communication	30
5000	Wholesale Trade	140
5200	Retail Trade	460
6590	Real Estate and Insurance Agents	30
7200	Hotels; Personal Services	58
7301	Business Services	60
8061	Hospitals	30
8211	Elementary and Secondary Schools	110
8486	Nonprofit Membership Organizations	40
9200	State Government	80
9300	Local Government	140

II. FOUR-DAY SCENARIO

Code	Sector Description	Employment Gain
1511	General Contractors	30
4811	Telephone Communication	30
5000	Wholesale Trade	130
5200	Retail Trade	420
6590	Real Estate and Insurance Agents	30
7200	Hotels; Personal Services	48
7301	Business Services	50
8061	Hospitals	30
8211	Elementary and Secondary Schools	100
8486	Nonprofit Membership Organizations	50
9200	State Government	70
9300	Local Government	120

APPENDIX C

Conversion of Direct Employment Data
to Final Demand
1985 - 2000

TABLE C.1

CONVERSION OF DIRECT EMPLOYMENT DATA TO FINAL DEMAND - 1985 (19.6 million tons)

BRIO SIC Code	Employment Category	Direct Employ-ment	Output Per Employee (1)	Final Demand (2) (Millions)	Trade Coeffic-ient (3)	Adjusted Final Demand (2,4) (millions)
4011	Railroad Workers	1,260	$ 11,163	$ 14.065	.118390	118.802
3731	Shipyards	79	92,978	7.345	1.0	7.345
4400	Coal Terminal	177	55,920	9.898	1.0	9.898
7301	Coal Testers	32	12,986	.416	.7	.594
4400	Towing	30	55,920	1.678	1.0	1.678
4400	Pilots	11	55,920	.615	1.0	.615
4400	Agents	35	55,920	1.957	1.0	1.957
4400	Chandlers, Surveyors and Bunkering Firms	8	55,920	.447	1.0	.447
7200	Local Service	129	14,250	1.838	.58	3.169
4400	Launch Crews	7	55,920	.391	1.0	.391
9880	Government(5)	30	-	.399	1.0	.399
6020	Banks and Insurance	15	31,900	.478	.6	.797
	Total	1,813		39.527		146.092

(1) From the BRIO model in 1972 dollars.
(2) In 1972 dollars.
(3) From the BRIO model, represents proportion of regional demand satisfied by regional production.
(4) Final Demand divided by the Trade Coefficient.
(5) Since the Federal Government sector is placed outside of the transactions matrix, the employment impact is proxied by wages paid to households (SIC 9880) in 1972 dollars.

TABLE C.2

CONVERSION OF DIRECT EMPLOYMENT DATA TO FINAL DEMAND - 1990 (27.5 million tons)

BRIO SIC Code	Employment Category	Direct Employ-ment	Output Per Employee (1)	Final Demand (2) (Millions)	Trade Coeffic-ient (3)	Adjusted Final Demand (2,4) (millions)
4011	Railroad Workers	1,575	$ 11,163	$ 17.582	.118390	148.509
3731	Shipyards	96	92,978	8.926	1.0	8.926
4400	Coal Terminal	377	55,920	21.082	1.0	21.082
7301	Coal Testers	39	12,986	.506	.7	.723
4400	Towing	37	55,920	2.069	1.0	2.069
4400	Pilots	14	55,920	.783	1.0	.783
4400	Agents	42	55,920	2.349	1.0	2.349
4400	Chandlers, Surveyors and Bunkering Firms	10	55,920	.559	1.0	.559
7200	Local Service	158	14,250	2.252	.58	3.883
4400	Launch Crews	9	55,920	.503	1.0	.503
9880	Government(5)	37	-	.492	1.0	.492
6020	Banks and Insurance	15	31,900	.478	.6	.797
	Total	2,409		57.581		190.675

(1) From the BRIO model in 1972 dollars.
(2) In 1972 dollars.
(3) From the BRIO model, represents proportion of regional demand satisfied by regional production.
(4) Final Demand divided by the Trade Coefficient.
(5) Since the Federal Government sector is placed outside of the transactions matrix, the employment impact is proxied by wages paid to households (SIC 9880) in 1972 dollars.

TABLE C.3

CONVERSION OF DIRECT EMPLOYMENT DATA TO FINAL DEMAND - 1995 (30.6 million tons)

BRIO SIC Code	Employment Category	Direct Employ- ment	Output Per Employee (1)	Final Demand (2) (Millions)	Trade Coeffic- ient (3)	Adjusted Final Demand (2,4) (millions)
4011	Railroad Workers	1,697	$ 11,163	$ 18.944	.118390	160.014
3731	Shipyards	108	92,978	10.042	1.0	10.042
4400	Coal Terminal	377	55,920	21.082	1.0	21.082
7301	Coal Testers	43	12,986	.558	.7	.797
4400	Towing	41	55,920	2.293	1.0	2.293
4400	Pilots	15	55,920	.839	1.0	.839
4400	Agents	47	55,920	2.628	1.0	2.628
4400	Chandlers, Surveyors and Bunkering Firms	11	55,920	.615	1.0	.615
7200	Local Service	176	14,250	2.508	.58	4.324
4400	Launch Crews	10	55,920	.559	1.0	.559
9880	Government(5)	41	-	.546	1.0	.546
6020	Banks and Insurance	17	31,900	.542	.6	.903
	Total	2,583		61.156		204.642

(1) From the BRIO model in 1972 dollars.
(2) In 1972 dollars.
(3) From the BRIO model, represents proportion of regional demand satisfied by regional production.
(4) Final Demand divided by the Trade Coefficient.
(5) Since the Federal Government sector is placed outside of the transactions matrix, the employment impact is proxied by wages paid to households (SIC 9880) in 1972 dollars.

TABLE C.4

CONVERSION OF DIRECT EMPLOYMENT DATA TO FINAL DEMAND - 2000 (37.7 million tons)

BRIO SIC Code	Employment Category	Direct Employ- ment	Output Per Employee (1)	Final Demand (2) (Millions)	Trade Coeffic- ient (3)	Adjusted Final Demand (2,4) (millions)
4011	Railroad Workers	1,980	$ 11,163	$ 22.103	.118390	$ 186.696
3731	Shipyards	132	92,978	12.273	1.0	12.273
4400	Coal Terminal	377	55,920	21.082	1.0	21.082
7301	Coal Testers	53	12,986	.688	.7	.983
4400	Towing	50	55,920	2.796	1.0	2.796
4400	Pilots	18	55,920	1.006	1.0	1.006
4400	Agents	58	55,920	3.243	1.0	3.243
4400	Chandlers, Surveyors and Bunkering Firms	14	55,920	.782	1.0	.782
7200	Local Service	217	14,250	3.092	.58	5.331
4400	Launch Crews	12	55,920	.671	1.0	.671
9880	Government(5)	50	-	.666	1.0	.666
6020	Banks and Insurance	20	31,900	.638	.6	1.063
	Total	2,981		69.040		236.592

(1) From the BRIO model in 1972 dollars.
(2) In 1972 dollars.
(3) From the BRIO model, represents proportion of regional demand satisfied by regional production.
(4) Final Demand divided by the Trade Coefficient.
(5) Since the Federal Government sector is placed outside of the transactions matrix, the employment impact is proxied by wages paid to households (SIC 9880) in 1972 dollars.

TABLE C.5

CONVERSION OF DIRECT EMPLOYMENT DATA TO FINAL DEMAND - 2000 (50.1 million tons)

BRIO SIC Code	Employment Category	Direct Employ- ment	Output Per Employee (1)	Final Demand (2) (millions)	Trade Coeffic- ient (3)	Adjusted Final Demand (2,4) (millions)
4011	Railroad Workers	2,474	$ 11,163	$ 27.617	.118390	$ 233.271
3731	Shipyards	176	92,978	16.364	1.0	16.364
4400	Coal Terminal	477	55,920	26.673	1.0	26.673
7301	Coal Testers	70	12,986	.909	.7	1.298
4400	Towing	67	55,920	3.747	1.0	3.747
4400	Pilots	25	55,920	1.398	1.0	1.398
4400	Agents	77	55,920	4.305	1.0	4.305
4400	Chandlers, Surveyors and Bunkering Firms	19	55,920	1.062	1.0	1.062
7200	Local Service	289	14,250	4.118	.58	7.100
4400	Launch Crews	16	55,920	.895	1.0	.895
9880	Government(5)	67	-	.892	1.0	.892
6020	Banks and Insurance	20	31,900	.638	.6	1.063
	Total	3,777		88.618		298.068

(1) From the BRIO model in 1972 dollars.
(2) In 1972 dollars.
(3) From the BRIO model, represents proportion of regional demand satisfied by regional production.
(4) Final Demand divided by the Trade Coefficient.
(5) Since the Federal Government sector is placed outside of the transactions matrix, the employment impact is proxied by wages paid to households (SIC 9880) in 1972 dollars.

TABLE C.6

1985 COAL RELATED DIRECT EMPLOYMENT
AND FINAL DEMAND FOR THE BRIO MODEL

BRIO SIC Code	Description	Employ-ment	Final Demand 1/ (millions)	Adjusted Final Final Demand 1/ (millions)
4011	Railroads	1,260	$ 14.054	$ 118.802
4400	Water Transportation	268	14.986	14.986
3731	Ship Building	79	7.345	7.345
7301	Business Services	32	.416	.594
7200	Hotels; Personal Services	129	1.838	3.169
9880	Government (2)	30	.399	.399
6020	Commerical Banks	15	.478	.797
	Total	1,813	39.516	146.092

(1) In 1972 dollars.
(2) Represents wages paid by the government sector to households.

TABLE C.7

1990 COAL RELATED DIRECT EMPLOYMENT AND FINAL DEMAND FOR THE BRIO MODEL

BRIO SIC Code	Description	Employ-ment	Final Demand 1/ (millions)	Adjusted Final Final Demand 1/ (millions)
4011	Railroads	1,575	$ 17.570	$ 148.509
4400	Water Transportation	489	27.345	27.345
3731	Ship Building	96	8.926	8.926
7301	Business Services	39	.506	.723
7200	Hotels; Personal Services	158	2.252	3.883
9880	Government (2)	37	.492	.492
6020	Commerical Banks	15	.478	.797
	Total	2,409	57.581	190.675

(1) In 1972 dollars.
(2) Represents wages paid by the government sector to households.

TABLE C.8

1995 COAL RELATED DIRECT EMPLOYMENT AND
FINAL DEMAND FOR THE BRIO MODEL

BRIO SIC Code	Description	Employ-ment	Final Demand (millions)	Adjusted Final Final Demand 1/ (millions)
4011	Railroads	1,697	$ 18.944	$ 160.014
4400	Water Transportation	501	28.016	28.016
3731	Ship Building	108	10.042	10.042
7301	Business Services	43	.558	.797
7200	Hotels; Personal Services	176	2.508	4.324
9880	Government (2)	41	.546	.546
6020	Commerical Banks	17	.542	.903
	Total	2,583	61.156	204.642

(1) In 1972 dollars.
(2) Represents wages paid by the government sector to households.

TABLE C.9

2000 COAL RELATED DIRECT EMPLOYMENT AND FINAL DEMAND FOR THE BRIO MODEL

BRIO SIC Code	Description	Employ-ment	Final Demand (millions)	Adjusted Final Final Demand 1/ (millions)
4011	Railroads	1,980	$ 22.103	$ 186.696
4400	Water Transportation	529	29.580	29.580
3731	Ship Building	132	12.273	12.273
7301	Business Services	53	.688	.983
7200	Hotels; Personal Services	217	3.092	5.331
9880	Government (2)	50	.666	.666
6020	Commerical Banks	20	.638	1.063
	Total	2,981	69.041	236.592

(1) In 1972 dollars.
(2) Represents wages paid by the government sector to households.

TABLE C.10

2000 COAL RELATED DIRECT EMPLOYMENT
AND FINAL DEMAND FOR THE BRIO MODEL ("HIGH" SCENARIO)

BRIO SIC Code	Description	Employ-ment	Final Demand (millions)	Adjusted Final Final Demand 1/ (millions)
4011	Railroads	2,474	$ 27.617	$ 233.271
4400	Water Transportation	681	38.08	38.08
3731	Ship Building	176	16.364	16.364
7301	Business Services	70	.909	1.298
7200	Hotels; Personal Services	289	4.118	7.100
9880	Government (2)	67	.892	.892
6020	Commerical Banks	20	.638	1.063
	Total	3,777	88.62	298.068

(1) In 1972 dollars.
(2) Represents wages paid by the government sector to households.

APPENDIX D

Breakdown of Overall Increases in
Output and Employment
1985 - 2000

TABLE D.1

1985 COAL IMPACT TEST
SECTORAL CHANGES IN REGIONAL DEMAND, PRODUCTION AND EMPLOYMENT*

	Change in Regional Production 1/		Change in Regional Employment	
	Additional**	Total***	Additional**	Total***
Agricultural Products And Services	$ .42	$ .42	--	--
Mining and Extraction	.02	.02	--	--
Construction	10.35	10.35	104	104
Nondurable Manufacturing	8.55	8.65	73	73
Durable Manufacturing	6.79	22.48	74	155
Transportation, Communication and Utilities	10.13	72.17	127	1,653
Wholesale Trade	9.38	9.38	176	176
Retail Trade	14.22	14.22	571	571
Finance, Insurance and Real Estate	10.43	11.45	99	114
Personal, Business and Other	14.92	19.74	445	606
State and Local Govt.	12.82	12.82	218	248
Wage and Salary/ Consumer Exp.	81.87	81.87	--	--
TOTAL	$179.90	$263.47	1,887	3,700

1/ Millions of 1983 Dollars.
* Totals may differ slightly from Table 3.7 due to rounding.
** Includes indirect and induced impacts.
*** Includes direct, indirect and induced impacts.

TABLE D.2

1990 COAL IMPACT TEST
SECTORAL CHANGES IN REGIONAL DEMAND, PRODUCTION AND EMPLOYMENT*

	Change in Regional Production 1/		Change in Regional Employment	
	Additional**	Total***	Additional**	Total***
Agricultural Products And Services	$ .58	$ .58	--	--
Mining and Extraction	.02	.02	--	--
Construction	16.37	16.37	185	185
Nondurable Manufacturing	11.66	11.66	123	123
Durable Manufacturing	10.24	29.32	96	192
Transportation, Communication and Utilities	14.74	110.72	191	2,255
Wholesale Trade	13.26	13.26	246	246
Retail Trade	19.52	19.52	770	770
Finance, Insurance and Real Estate	14.66	15.68	128	143
Personal, Business and Other	20.52	26.43	599	796
State and Local Govt.	18.06	18.06	311	348
Wage and Salary/ Consumer Exp.	111.22	112.27	--	--
TOTAL	$250.85	$373.89	2,649	5,058

1/ Millions of 1983 Dollars.
* Totals may differ slightly from Table 3.7 due to rounding.
** Includes indirect and induced impacts.
*** Includes direct, indirect and induced impacts.

TABLE D.3

1995 COAL IMPACT TEST
SECTORAL CHANGES IN REGIONAL DEMAND, PRODUCTION AND EMPLOYMENT*

	Change in Regional Production 1/		Change in Regional Employment	
	Additional**	Total***	Additional**	Total***
Agricultural Products And Services	$ .61	$ .61	--	--
Mining and Extraction	.02	.02	--	--
Construction	17.13	17.13	185	185
Nondurable Manufacturing	12.51	12.51	123	123
Durable Manufacturing	10.85	32.30	126	234
Transportation, Communication and Utilities	15.61	115.94	198	2,396
Wholesale Trade	14.16	14.16	257	257
Retail Trade	20.93	20.93	823	823
Finance, Insurance and Real Estate	15.63	16.79	157	174
Personal, Business and Other	22.02	28.57	639	858
State and Local Govt.	19.27	19.27	328	369
Wage and Salary/ Consumer Exp.	119.34	120.52	--	--
TOTAL	$268.08	$398.75	2,836	5,419

1/ Millions of 1983 Dollars.
* Totals may differ slightly from Table 3.7 due to rounding.
** Includes indirect and induced impacts.
*** Includes direct, indirect and induced impacts.

TABLE D.4

2000 COAL IMPACT TEST
SECTORAL CHANGES IN REGIONAL DEMAND, PRODUCTION AND EMPLOYMENT*

	Change in Regional Production 1/		Change in Regional Employment	
	Additional**	Total***	Additional**	Total***
Agricultural Products And Services	$ .72	$ .72	--	--
Mining and Extraction	.02	.02	--	--
Construction	18.84	18.84	194	194
Nondurable Manufacturing	14.40	14.40	143	143
Durable Manufacturing	12.20	38.41	130	262
Transportation, Communication and Utilities	17.62	128.04	235	2,744
Wholesale Trade	16.13	16.13	295	295
Retail Trade	24.05	24.05	937	937
Finance, Insurance and Real Estate	17.81	19.19	183	203
Personal, Business and Other	25.29	33.36	744	1,014
State and Local Govt.	21.94	21.94	367	417
Wage and Salary/ Consumer Exp.	137.42	138.85	--	--
TOTAL	$306.44	$453.95	3,228	6,209

1/ Millions of 1983 Dollars.
* Totals may differ slightly from Table 3.7 due to rounding.
** Includes indirect and induced impacts.
*** Includes direct, indirect and induced impacts.

TABLE D.5

2000 COAL IMPACT TEST ("HIGH SCENARIO")
SECTORAL CHANGES IN REGIONAL DEMAND, PRODUCTION AND EMPLOYMENT*

	Change in Regional Production 1/		Change in Regional Employment	
	Additional**	Total***	Additional**	Total***
Agricultural Products And Services	$ .91	$ .91	--	--
Mining and Extraction	.05	.05	--	--
Construction	24.19	24.19	253	253
Nondurable Manufacturing	18.44	18.44	182	182
Durable Manufacturing	15.80	50.76	176	352
Transportation, Communication and Utilities	22.60	162.97	299	3,454
Wholesale Trade	20.70	20.70	374	374
Retail Trade	30.81	30.81	1,194	1,194
Finance, Insurance and Real Estate	22.81	24.19	185	252
Personal, Business and Other	32.39	43.13	963	1,322
State and Local Govt.	28.09	28.09	516	536
Wage and Salary/ Consumer Exp.	175.72	177.63	--	--
TOTAL	$392.51	$581.87	4,142	7,919

1/ Millions of 1983 Dollars.
* Totals may differ slightly from Table 3.7 due to rounding.
** Includes indirect and induced impacts.
*** Includes direct, indirect and induced impacts.

APPENDIX E

Air Quality Methodology

APPENDIX E

AIR QUALITY METHODOLOGY

Nimerick and Laflin determined that between 0.5 percent and 2 percent of coal by weight was lost to wind erosion during their tests.[1] Using the lower figure for 1982 volume of coal shipped, assuming only 10 percent of total emission inside the region,

13 million tons X .005 X .1 = 6,500 tons were emitted in region.

The Chessie tracks run approximately 42.5 miles inside the region, and it would take 3.38 trains per day (average for 365 days):

6,500 tons X 2000 lbs. ÷ 365 days ÷ 3.38 trains/day ÷ 42.5 miles = 248 lbs/mile/day/train.

Using the same formula for a "most likely" projection of 37.7 million tons for the year 2000 yields 18,850 tons annually emitted in the region. The low projection of 24 million tons would yield 12,000 tons annually for the same year.

[1] Nimerick, K. H., and Laflin, G. P. "Intransit Wind Erosion Losses of Coal and Method of Control." Presented at the 1977 Society of Mining Engineers Fall Meeting and Exhibit, St.Louis, Missouri - October 19-21, 1977. (Preprint Number 77-F-377.)

APPENDIX F

Noise Impact Methodology

APPENDIX F

COMPUTATION OF DAY/NIGHT NOISE LEVELS (L_{dn})[1]

Average day/night noise levels (L_{dn}) for rail traffic were calculated using a model from the U.S. EPA, Office of Noise Abatement and Control, for freight traffic. In general, trains are assumed to be traveling at 33 miles per hour, with 130 cars per train. Also, two-thirds were assumed to be traveling during the day, one-third at night.

To determine the number of people exposed to various levels of L_{dn}, it is necessary to determine

- o The energy radiated into the community by a single train passing by.
- o The equivalent energy radiated by average train traffic.
- o How the intensity of the sound varies with distance from the track.

The Single-Event Noise Exposure Level (SENEL) of a group of n locomatives passing by a fixed observer at perpendicular distance r_0 from a track is given by the formula:

$$(SENEL)_L = L_L + 10 \log \left(\frac{\pi}{2} \frac{r_0}{V}\right) + 10 \log n$$

where the subscript L denotes locomotive, L_L is the level measured by a stationary observer at distance r_0 from the locomotive, and V is the locomotive speed in ft. per sec.[2]

The value of L_L used is the 1980 EPA standard maximum for locomotive standing still (87 dBA). Higher levels are allowed for moving locomotives (90 and 96 dBA); however, the lower figure was used to produce a more conservative estimate. For a freight train with three locomotives traveling at 33 mph:

[1]Background Document for Railroad Noise Emmission Standards. EPA #550/9-76-005, December 1975.

[2]A theoretical derivation of this expression is given in Rudd and Blackman (61). According to that derivation, the second term should be 10 log ($\pi r/V$). Experience with actual passby measurements indicates that 10 log ($\pi r/2V$) gives a better approximation to the data.

$$SENEL_L = 87\ dBA + 10\ \log\ (\frac{\pi}{2}\ \frac{100\ ft}{48\ ft/sec}) + 5\ dB$$

$$= 96.1\ dBA\ at\ 100\ ft.$$

The energy radiated by the cars in a train as measured at 100 ft. is expressed as:

$$SENEL_C = 72 + 30\ \log \frac{V}{20} + 10\ \log\ t$$

where V is train speed in miles per hour and t is the passby time in seconds (Source: Bender et al., 1974).

For a train speed of 33 mph and a passby time of 135 sec (130 cars X 50 ft/car ÷ 48 ft/sec):

$$SENEL_T = 10\ \log \left[\log^{-1} (\frac{SENEL_L}{10}) + \log^{-1} (\frac{SENEL_C}{10}) \right]$$

$$= 101.3\ dBA\ at\ 100\ ft.$$

In the preceding expression, T denotes total.

To compute the equivalent day-night energy level, the SENELs for all events are summed and divided by 24 hours, while the nighttime events are weighted by a factor of 10. Table F.1 shows that approximately three trains move over the average segment of track each day under current conditions. (Passenger trains are typically 10 to 20 dB quieter than freight trains and so are excluded from the exposure estimate). Assuming that the train movements are distributed evenly through the day, this traffic breaks down into one night and two day events. The equivalent number of movements if, therefore, 1 X 10 + 3 = 3. The L_{dn} at 100 ft. from a segment of average track is, therefore:

$$L_{dn} = SENEL_T + 10\ \log\ 13 - 10\ \log\ (3600\ sec/hr \times 24\ hrs)$$
$$= 63.1\ dBA.$$

TABLE F.1

TRAIN TRAFFIC ON CHESSIE/PATAPSCO RIVER CORRIDOR

	Annual Tons Exported (millions)	Number of Daily Trains (both directions)[1]
1982 Volume - Existing Terminals	13	8
Full Capacity - Existing Terminals	29	15
Additional Terminal - Marley Neck	44	23

[1]Number of trains computed by assuming 130 cars per train with 81 tons per car, distributed evenly over the year.

If train movements were increased to 15 per day (full capacity of Curtis Bay and Island Creek Terminals), the result would be:

$$L_{dn} = SENEL_T + 10 \log 60 - 10 \log (3600 \text{ sec/hr X } 24 \text{ hrs})$$
$$= 69.7 \text{ dBA.}$$

If a Marley Neck Terminal were also shipping 15 million tons annually (total of 25 train movements):

$$L_{dn} = SENEL_T + 10 \log 96 - 10 \log (3600 \text{ sec/hr X } 24 \text{ hrs})$$
$$= 71.8 \text{ dBA.}$$

The model for train noise propagation into communities is based on the model developed for urban highway noise by Kugler, Commins, and Galloway (72). The theory on which that model is based shows the noise falloff with distance from the track (or highway) to be 4.5 dB per doubling of distance. In addition, there will be another 4.5 dB of attenuation caused by the shielding effects of the first row of buildings next to the track. The attenuation behavior is approximated by using a straight line falling off at a rate of 6 dB per doubling of distance. This approximation is reasonably accurate (given the uncertainty of the precise location of the shielding buildings) out to about 700 ft., which is beyond the limit of the range of interest.

APPENDIX G

Cost/Benefit Tables

TABLE G.1

TOTAL BENEFITS, "MOST LIKELY SCENARIO," 1985-2004
(Millions of 1983 Dollars)

	1985-89[1]	1990-94	1995-99	2000-04
Regional Output[2]	175.07	250.87	268.12	306.47
Local Personal Income Taxes[3]	1.35	1.82	1.95	2.25
Local Corporate Personal & Property Taxes[4]	.668	.668	.668	.668
State Personal Income Taxes[5]	2.65	3.60	3.87	4.44
State Corporate Personal & Property Taxes[6]	.019	.019	.019	.019
State Corporate Income Taxes[7]	1.03	1.43	1.53	1.75
State Sales Taxes[8]	.69	.93	.99	1.14
TOTAL[9]	181.477	259.34	277.15	316.74

1 Amounts shown are annual figures for each year indicated in column heading.
2 Total Net Present Value = $1,852.541
3 " " " " " = 13.630
4 " " " " " = 5.429
5 " " " " " = 26.901
6 " " " " " = .156
7 " " " " " = 10.563
8 " " " " " = 6.932
9 " " " " " = $1,916.152

TABLE G.2

TOTAL BENEFITS, "HIGH SCENARIO," 1985-2004
(Millions of 1983 Dollars)

	1985-89[1]	1990-94	1995-99	2000-04
Regional Output[2]	175.07	250.87	268.12	392.53
Local Personal Income Taxes[3]	1.35	1.82	1.95	2.88
Local Corporate Personal & Property Taxes[4]	.668	.668	.668	2.114
State Personal Income Taxes[5]	2.65	3.60	3.87	5.70
State Corporate Personal & Property Taxes[6]	.019	.019	.019	.030
State Corporate Income Taxes[7]	1.03	1.43	1.53	2.240
State Sales Taxes[8]	.69	.93	.99	1.47
TOTAL[9]	181.477	259.34	277.15	406.964

1 Amounts shown are annual figures for each year indicated in column heading.

2 Total Net Present Value = $1,926.983
3 " " " " " = 14.171
4 " " " " " = 6.679
5 " " " " " = 27.984
6 " " " " " = .166
7 " " " " " = 10.992
8 " " " " " = 7.212
9 " " " " " = $1,994.186

TABLE G.3

TOTAL COSTS, "MOST LIKELY SCENARIO," 1985-2004
(Millions of 1983 Dollars)

	1985	1986	2004
Boston Grade Separation[1] (B. City)	7.8	7.8	
Speed Sensitive Signals[2] (B. City)	.8		
Grade Separation at Marriottsville Road[3] (Howard & Carroll Counties)	3.0	3.0	
Fencing[4] (B. City)	.124		
Relocation of Recreational Facilities[5] (B. City)		.150	
Noise/Visual Barriers[6] (B. City)		.361	
TOTALS[7]	11.724	11.311	

1 Total Net Present Value = $13.00
2 " " " " " = .7
3 " " " " " = 4.9
4 " " " " " = .11
5 " " " " " = .12
6 " " " " " = .28
7 " " " " " = $19.11

TABLE G.4

ADDITIONAL COSTS ASSOCIATED WITH THE "HIGH SCENARIO"
(Millions of 1983 Dollars)

	2000
Pennington Avenue Grade Separation[1] (B. City)	12.04
Speed Sensitive Signals[2] (Quarantine Road, Old Hawkins Point Road, Ordnance Road) (B. City)	.36
Detour & Emergency Access[3] (A. A. County)	1.81
TOTAL[4]	14.21

1 Total Net Present Value = $2.53
2 " " " " " = .12
3 " " " " " = .36
4 " " " " " = $3.01